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ELECTRICAL REVIEW

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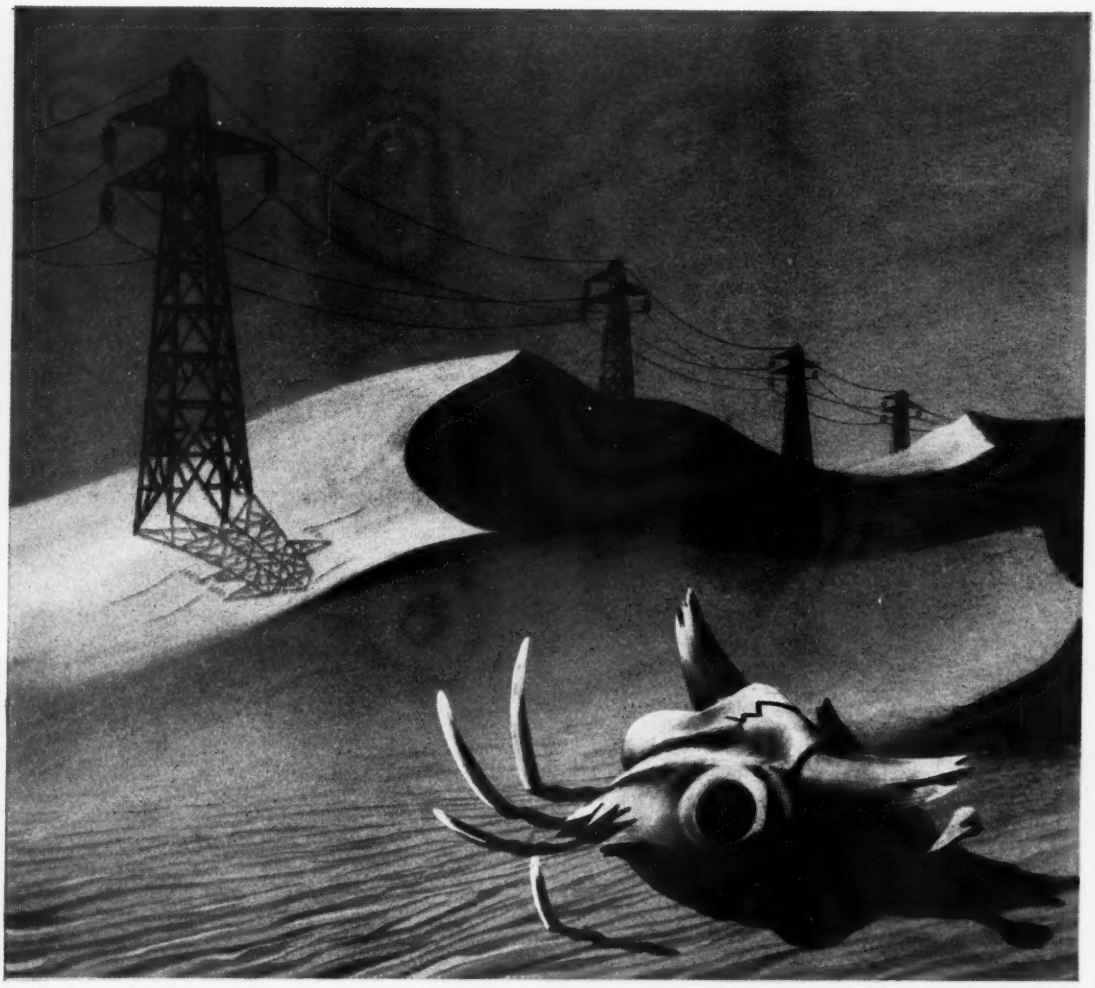

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14 DECEMBER 1956

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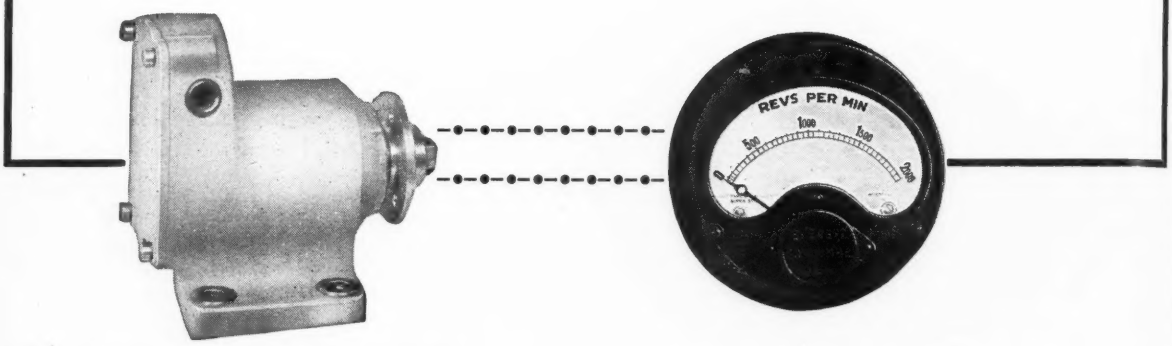
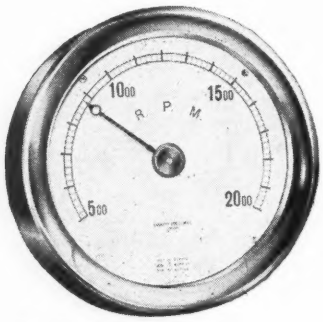
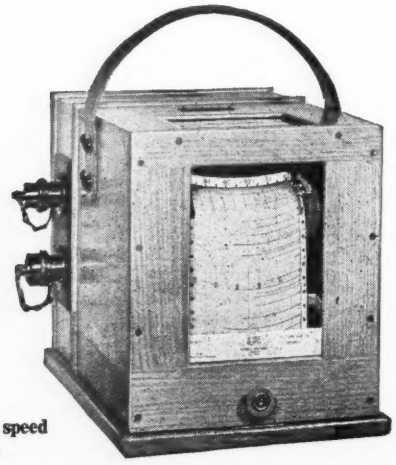
Electric Speedmeters



Typical speed transmitter for floor or bracket mounting.



Disc scale indicating speedmeter.



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ELECTRICAL REVIEW

14 December 1956 Vol. 159 No. 24 Established 1872

Nuclear Power Generation

ONE of the points brought out at the recent symposium of papers on the Calder Works nuclear power plant was that nuclear energy-steam electricity generation would prove directly competitive with coal-steam electricity generation. Now this prophecy has been followed by the Central Electricity Authority's announcement (reported in our issue of 7th December) that it has been decided to install a turbo-alternator with a capacity as high as 550 MW—presumably in a conventional coal-steam power station.

We await with keen interest news of the capacities of the generating sets and of the steam conditions to be adopted for the first of the Central Electricity Authority nuclear power stations which have already been tendered for. The 550 MW generating set referred to represents a big advance upon the 200 MW set, the largest, we believe, in the adopted C.E.A. programme so far, but the steam conditions to be employed in the largest set are to be the same as those for the 200 MW sets.

We cannot imagine anything like an approach to these latest capacity and steam condition figures for the first nuclear energy stations because of the very low figures adopted for Calder Hall and because we feel that, despite the enormous strides that have been made in nuclear energy engineering, the development must continue to be evolutionary. We must say this cautiously, however, because another point which was brought out in the symposium was that while the papers and discussions were revealing the extraordinary advances made up to the time of the design of Calder Hall (1953), in the past three years new designs, although based on Calder Hall with only marginal improvements, showed remarkable improvement in thermal efficiency.

We must not forget that at Calder Hall electricity is a " by-product," and that this must have had a considerable influence on the design. The production of plutonium affected such items as coolant temperatures more than did the production of electricity. It is now clear that the further economic generation of electricity from nuclear energy rests on the larger size of reactor, while on this depends the possible steam pressure; the problems of heat transfer are not basically different from those associated with the conventional type of plant, the nature of the material and the temperature being responsible for the main differences. Although lower pressure steam is used at Calder Hall, this does allow a greater amount of electricity to be sent out at a somewhat lower thermal efficiency; an essential point of design, at first to be guessed, was at what temperature the reactor would operate.

All these points in the aggregate seem to open the door a little wider and to support the contention of Sir Christopher Hinton, managing director, Industrial Group Headquarters, Atomic Energy Authority, that the Calder Hall type of reactor will still be installed in 25 years' time, although in the latter part of the intervening period liquid types of reactors will be introduced.

ACCELERATED DEVELOPMENT

Mr. Aubrey Jones, the Minister of Fuel and Power, is expected to announce next Monday plans for accelerating and expanding the nuclear power station programme. As we went to press the Central Electricity Authority was expected to announce at any moment the allocation of the contracts for its first two stations—Bradwell and Berkeley. An announcement from the South of Scotland Electricity Board of the award of the contract for its projected station is also expected very soon.

The oil situation has given nuclear power development even greater importance but progress must be governed to a great extent by the capacity of the four industrial groups (to be followed soon by a fifth) able to take on these large contracts. It is anticipated that it may be possible to double the originally planned programme figure by 1962 when as much as 1,400 MW of nuclear power plant may be available.

WATER-COOLED ALTERNATORS

Throughout the years there have been steady developments and improvements in boilers and turbines but with the exception of the introduction of hydrogen cooling a few years ago, the alternator has undergone very little change for many years. A major step forward has now been taken: the Metropolitan-Vickers Company has introduced an alternator with direct water-cooled stator windings. This machine has now successfully undergone its tests at Trafford Park and is fully described in this issue. Essentially the cooling system enables an 80 per cent reduction to be made in the copper requirement, thereby considerably reducing the space required for the accommodation of the stator conductors. This development will enable generators exceeding 200 MW capacity to be made within the present limits of transport in this country.

THE "MONKEY HOLE"

We have heard it said that Stewarts & Lloyds, Ltd., have been very fortunate to find a place like the "Monkey Hole," the disused quarry at Wirksworth in Derbyshire, in which they could establish a testing station for tall structures like transmission line towers which was described in last week's issue. We would prefer to put this another way, however; Stewarts & Lloyds have been very fortunate to have the personnel and advice which has enabled them to see the potentialities of the "Monkey Hole" in the direction indicated—which must have demanded the highest degree of engineering foresight and business acumen.

There have been the greatest difficulties in the past in connection with the testing of tall towers and masts because, as was said in the article, of the need to have a point of support for the rope at the same height as the top of the structure when applying horizontal loads. To excavate a chamber below ground or erect a structure above ground with facilities for side pulls at such a height in relation to the tower has presented a problem of finance well nigh unsolvable with some of the tallest of our transmission line towers. This can be appreciated when it is known that loads up to 30 tons are required for some tests. Add to such load facilities the accommodation for the load-applying winches and the extensive control equipment and instrumentation and one has a fuller measure of the great importance of the "Monkey Hole."

COMPUTER POTENTIALITIES

A few years ago electronic computers were comparatively rare and only to be found in Government research establishments or the mathematics departments of universities. These were largely makeshift equipments which were continually in a state of modification. Rapid developments have taken place, however, and now electronic computers, either analogue or digital, can be bought "over the counter" to suit a wide variety of requirements. The fact is that there is a rapidly increasing demand for these machines to take over some of man's simpler mental processes which, by the way, constitute about 90 per cent of the brain-work of most semi-skilled workers in factories and offices at the present time.

The shortage and cost of labour is making it increasingly uneconomic to employ human beings where there are machines which can do the same operations faster, cheaper and with greater reliability. The potentialities of computers, however, are not nearly so well known as they should be; many of our present manpower problems could be solved if they were used to the fullest advantage. What is needed is a fuller co-operation between executive officials, computer designers and mathematicians, to ensure that the maximum benefit is derived from the many technical developments which have taken place in recent years.

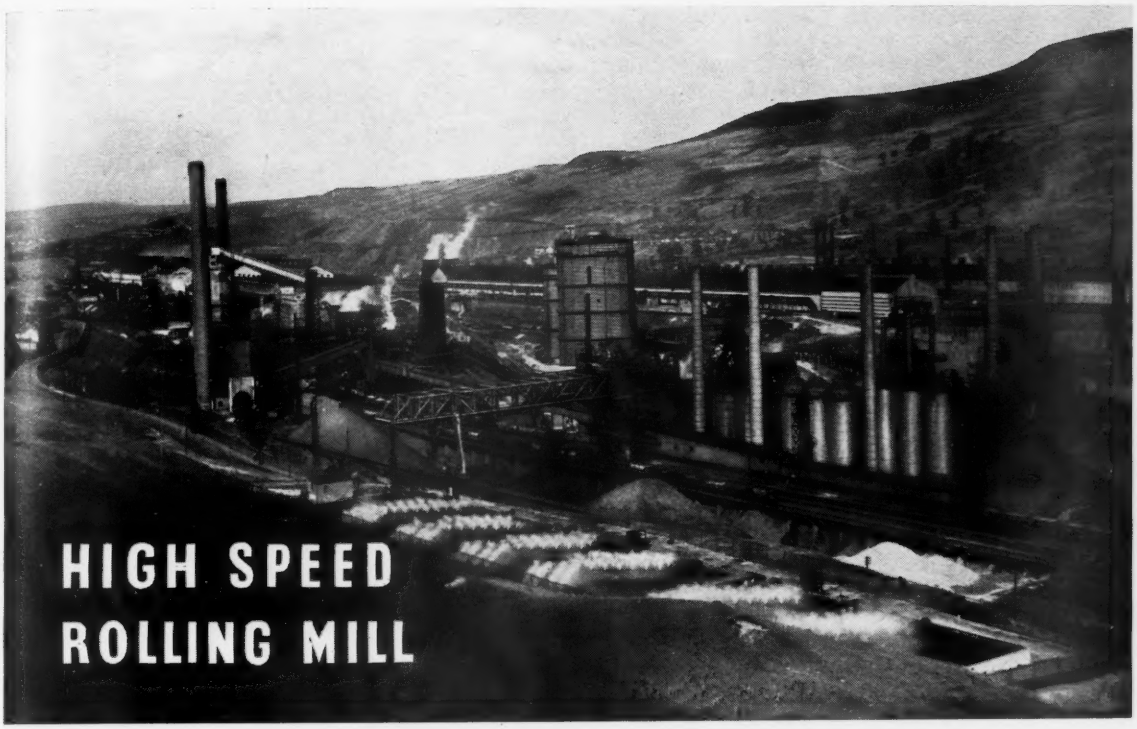
ANOMALY STRESSED

We have already protested against the purchase tax arrangements which allow solid fuel and oil heating appliances to go free while electric (and gas) heating equipment bears a tax of 60 per cent. This unfair discrimination is shown up in a much stronger light now that there is a shortage of oil which is likely to be prolonged. The original idea behind the penal taxation on electric heaters was to discourage their use in the face of a plant shortage—because of this they were at first treated more harshly than gas appliances. Now that the plant situation is easier and the use of imported fuel is undesirable the purchase tax should be re-examined and a more realistic policy adopted.

PENSIONS FOR ENGINEERS

As was foreshadowed about six months ago, the Engineers' Guild has produced a scheme of pensions for professional engineers—corporate or non-corporate members of the three leading engineering institutions. It is believed that the scheme will make it easier for engineers to move around. Movement is often restricted nowadays by the difficulty experienced by older men of securing acceptance in firms' pension arrangements.

On the face of it the scheme does not differ a great deal from the ordinary endowment policy system which individuals can adopt themselves, but the Guild says that by negotiating a group scheme it has been possible to secure more advantageous terms. It is also thought that employers may be willing to pay some or all of the contributions.



Cold Rolling Tinplate Production at Ebbw Vale

THE increasing demand for steel in this country has resulted in the introduction of faster and more powerful rolling mills for its production. As part of the overall development scheme at the Ebbw Vale, South Wales, works of Richard Thomas & Baldwins, Ltd., a new five-stand cold strip mill for tinplate gauge has recently been installed. Designed to roll strip at speeds up to 5,000 ft/min, nearly 60 m.p.h., this mill is one of the fastest in Europe. Included in this development programme has also been the installation of a new two-stand tandem temper mill for the further processing of strip and this is capable of speeds of up to 4,000 ft/min.

The new 21in by 53in by 42in five-stand tandem cold strip mill was built by the Davy & United Engineering Co., Ltd., and it replaces the original five-stand mill of American manufacture which had worked continuously for seventeen years, since 1938 when Richard Thomas & Baldwins became the first producers in Europe of tinplate by the continuous process. In its main duty, the reduction of hot rolled steel strip down to tinplate gauges, the mill's output is considerably above that of the old installation. The strip rolled ranges in width from 16in to 38in, the ingoing gauge being up to 0·11in maximum while the outgoing gauge is down to 0·006in minimum. The strip can be handled in coils weighing up to 36,000 lb each.

On the score of output, it is generally assumed to-day that a fast mill with a finishing speed of around 4,000/5,000 ft/min will comfortably produce at least 8,000 tons of tinplate in a week, but a considerably higher weekly tonnage than this can be expected when the new mill has worked up to full production and outputs of the order of 9,000-10,000 tons per week are regarded as well within the bounds of practical rolling possibilities. Rolling speeds of this order obviously demand driving power of equivalent magnitude, hence the reason for the total connected horsepower of 19,150 h.p. for the new 5,000 ft/min mill, against the 5,100 h.p. of the old mill which had a top speed of only 1,500 ft/min. The complete electric drive equipment for the main drives of the new five-stand unit and the two-stand tandem temper mill was supplied by the English Electric Co., Ltd.

Each stand of the five-stand mill is driven by direct-coupled motors through pinion stand and spindles, the latter being spring balanced in the case of Nos. 1, 2 and 3 stands and hydraulically balanced on stands Nos. 4 and 5 in which higher spindle speeds must be reckoned with. It should be noted that a high-speed mill lends itself to the selection of mill motor speeds which are suitable for direct-connected application with the result that reduction gear drives can be eliminated. This offers two advantages in that the stand centres can be closer together and inertia kept low by using single-, double- and triple-unit motors of smaller diameter. Low inertia ensures quick acceleration of the mill after "threading" which means a smaller amount of material scrapped as "off gauge." The motor ratings, powers and speeds are indicated in Table I.

Stand 1 is driven by a single-unit motor, stands 2, 3 and 4 and the coiler by double-unit motors and stand 5 by a triple-unit motor, the armatures being interchangeable

TABLE I.—PARTICULARS OF DRIVING MOTORS

Stand	No. of armatures	h.p.	r.p.m.	Strip speed ft/min
1	1	1,750	90/255	495/1,400
2	2	3,500	125/304	687/1,670
3	2	3,500	200/445	1,100/2,445
4	2	4,000	350/645	1,925/3,545
5	3	5,500	500/910	2,750/5,000
Coiler	2	900	233/1,000	5,000

within a multi-armature motor. Two 11 kV 9,000 h.p. 600 r.p.m. synchronous motor-generator sets supply the main drive motors at a maximum of 620 V d.c. through short copper runs, the ten main generators being identical and interchangeable machines. The 9,000 h.p. synchronous motors are arranged for reactor starting but can be started direct-on-line if necessary; automatic excitation control is provided.

Screwdown gear, built into the roll housings, consists on each stand of two 50 h.p. motors running at 550/1,650 r.p.m., coupled by a 24in diameter magnetic clutch and driving through double reduction gears and worm gears of 1,000 to 1 total ratio to give screwing speeds variable between 0·22in and 0·66in per minute. Selsyn units are fitted and limit switches prevent over-run. Provision is also made, in the shape of heavy cast steel make-up pieces between the 18in diameter mill screws and the top chocks, for the later fitting of loadmeters if it should be desired at some future date to measure the mill load electrically.

All of the main drive equipment is in a main motor room alongside the mill. The main drive motors and generators are force-ventilated on a re-circulatory system except for the commutators which are naturally ventilated, allowing easy access for inspection and maintenance. The bearings of these machines, in addition to having standard oil rings, are connected to two separate floor lubricating systems, each with its own standby unit. There are one main and three control exciter sets in the motor room, these machines being of the endshield ball and roller bearing type. The highly sensitive controls for the complete equipment depend on the operation of the control exciters and magnetic amplifiers.

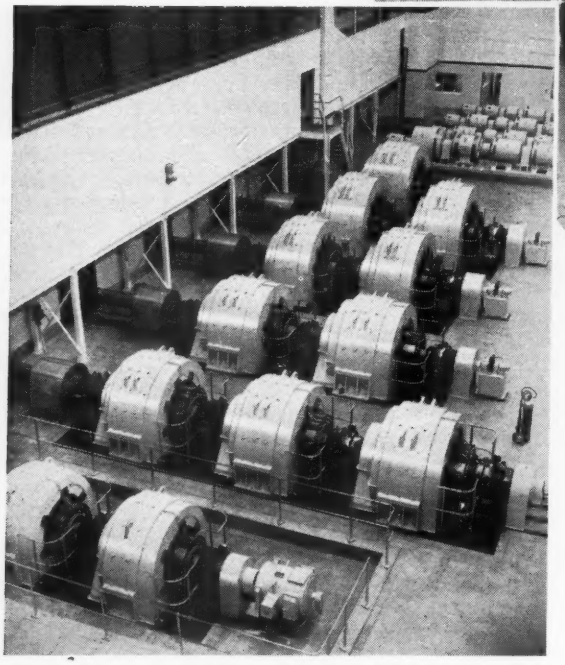
The mill operators' push-buttons, control switches and instruments for motor loading, speeds, strip gauge and tension are mounted on the stainless steel fronts of cabinets hinged to the entry and delivery sides of the mill housings. Easy swinging of the cabinets facilitates access to the mill for maintenance, adjustments and roll change. The cabinets have hinged doors and are fitted with internal heaters, socket outlets for 25 V handlamps and 110 V hand tools, and communication equipment between operators.

Neat electro-hydraulic control desks at the entry and delivery ends of the mill govern the numerous motions required for the operation of the various units of auxiliary equipment provided for the mill. The desk at the entry end includes hydraulic controls for the coil rotating rig elevator and tilting motions, the latter being remotely controlled from stand 1, as well as electric controls for the entry conveyor, entry ramp stop, coil rotating rig and hydraulic pumps. The delivery end desk contains all hydraulic controls connected with the motions of reel stripping, belt wrapping and coil weighing, air controls on the coil delivery ramp stop, tension reel brake and deflector plate, and the electric controls for the delivery conveyor hydraulic pumps and the sliding door to the safety cage which prevents access to the reel during coiling.

In a separate control room adjoining the main motor room is the supervisory board which sets up the electrical equipment for running and provides instrumentation and extensive alarm facilities. Behind this supervisory board is a corridor type control board having cubicle mounted magnetic amplifiers on one side and flat-back contactor gear on the other. The magnetic amplifiers are mounted on withdrawable chassis to facilitate checking or replacement. Many of the control and main circuits are monitored on a panel on the contactor board thus giving instant indication of the condition of such circuits, an essential feature for minimising the mill "down-time."

Also in the control room is the mill master control rheostat, this being of the motor-operated roller type having contact-making rollers running over vertical stacks of contacts connected to the resistance units. This construction enables a considerable number of rheostats to be

Right: New five-stand tandem cold reduction mill at Ebbw Vale and (below) main drive motors and reel motor for the five-stand mill



easily ganged together to control many quantities simultaneously. This mill master control rheostat is remotely controlled from the stand control cabinets.

In the basement of the motor room are the air circuit-breakers in the main generator-motor copper runs to provide isolation and dynamic braking of the motors. Alongside, near the main motor foundation blocks, are the motorised rheostats, of similar construction to the unit described above, for the individual speed control of the stand and coiler motors.

Referring to the mill motor speeds in Table I it will be observed that they give rise to a " speed cone " which allows a large range of rolling schedules to be accommodated by individual stand settings. This " speed cone " normally corresponds to the shunt field ranges of the stand motors but it is widened by further reduction of speed of each individual stand by generator voltage.

The procedure followed in setting up a mill of this type for a particular rolling programme is first to determine the gauge reduction to be made in each stand and relate it to the stand speeds, having regard to the available speed in the " speed cone." The motor shunt fields and the mill screws are then set to the estimated positions and the first coil can be entered into the mill at the low threading speed. The load on each stand motor and the inter-stand strip tensions must then be checked against the estimated values and the motor fields and mill screws adjusted accordingly.

In order to minimise strip wastage during the setting up of this type of mill it is essential that the " thread " speed shall be as low as possible. In actual practice the control scheme for this mill allows the thread speed on to the coiler to be adjustable over a range of 120 to 400 ft/min.

With the strip successfully threaded the mill must be accelerated to the programme top speed as quickly as possible in order again to reduce the production of " off-gauge " material to the minimum. It is well known that in any high-speed tandem mill changes in inter-stand tension and gauge with changes in speed are inherent in the nature of the operation. This " speed effect " is thought to be due to variation in roll and bearing lubrication, in roll deformation and in the speed of roll deformation between high and low speed. The effect is very apparent on high-speed tandem mills rolling down to thin gauges and has the same result as would be obtained by increasing screw pressure with increasing speed. The consequence is a decrease in output gauge with an increase in mill speed and vice versa.

Theoretically, a drive can be made to maintain the speed relationship between stands at all strip speeds and thus maintain gauge, but " speed effect "

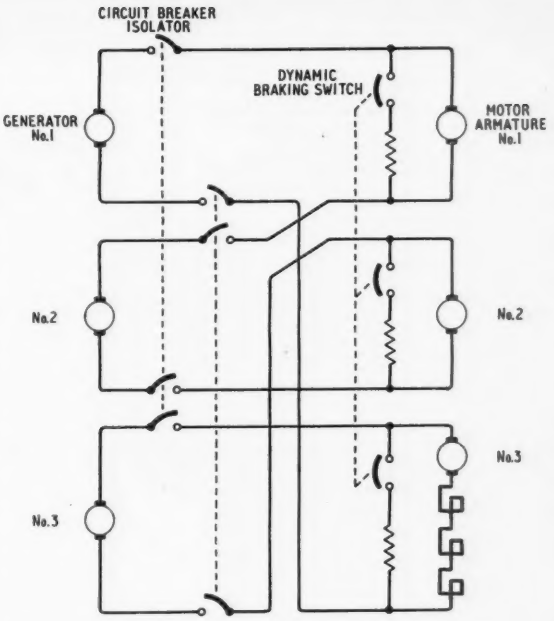
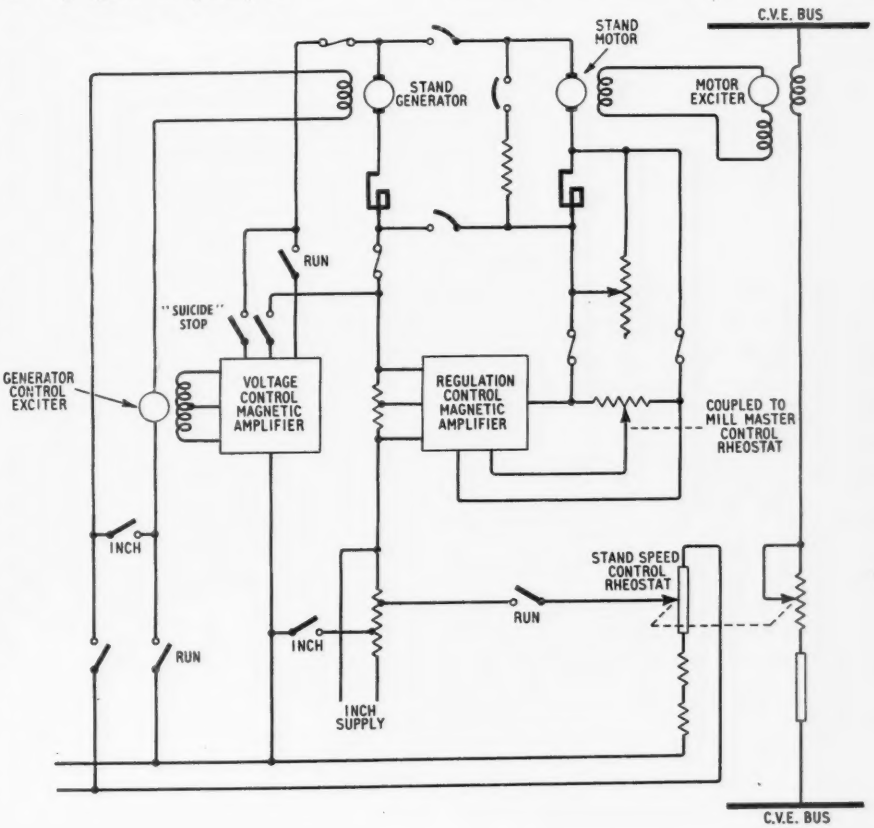


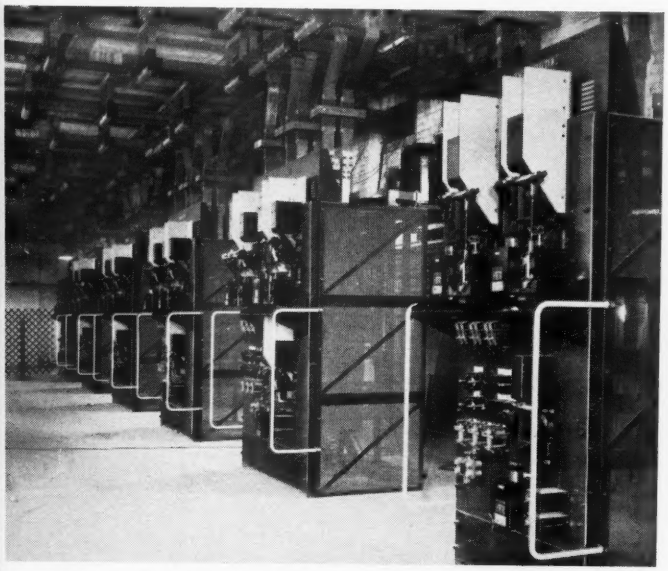
Fig. 1.—Main circuit connections for stand 5 of the 5,000 ft/min mill

Fig. 2.—Voltage control circuit for stand 1



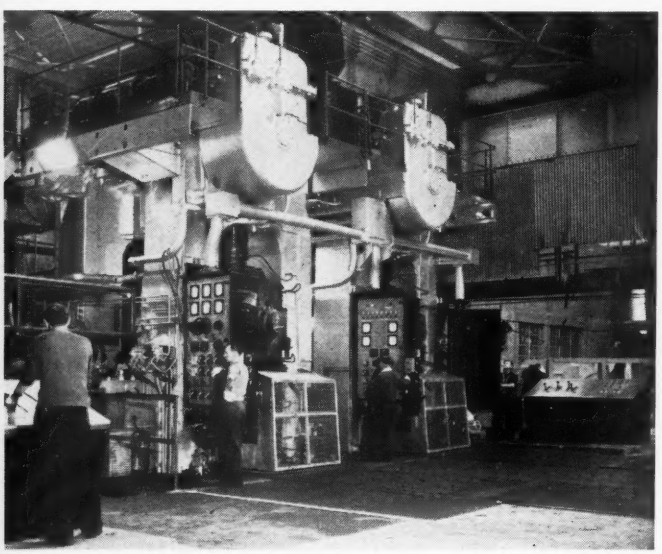
would then result in increasing inter-stand tensions on deceleration. On a wide speed range mill rolling thin material, this would result in strip breakage. In order to avoid breakage, provision has been made on the electric drive of this mill for a large degree of flexibility in adjustment of motor load-speed droop or " regulation " both as fixed amounts and as amounts depending automatically on speed. In this way the whole drive is given a characteristic such that the undesirable results of the inherent " speed effect " are minimised.

The requirements of the coiler drive are the same as in other mills of this type. The strip tension has to be maintained at a controlled steady value as the coil builds up on the drum. There are two independent servo-systems for achieving this control. A voltage control (of the coiler motor) acts on the coiler motor field to keep the motor voltage proportional to strip speed, independently of the coil build-up. A current control of the motor acts on the generator field to keep the motor armature current fixed at the value set by the operator. A speed limit control on the coiler provides automatic limitation to a peripheral speed only slightly above the strip speed at stand 5 and this protects the coiler against any substantial rise in speed in the event of strip breakage.



Main circuit-breakers and busbar system in the five-stand mill basement

General view of the new two-stand tandem temper mill



Details of Stand Drives

There is a separate generator for each mill and where a stand drive requires more than one motor the connection is " series sandwich " to ensure current sharing and the limitation of maximum voltage, which in this case is 620 V. This point is illustrated by Fig. 1, which shows the main circuit connections for stand 5. This arrangement is typical of all stands, the only distinction between stands being the number of armatures involved. The stand motor voltages are controlled to be equal at all times when the mill is running except that, as already mentioned, any stand may be working on reduced voltage to widen the " speed cone." Fig. 2 shows the voltage control circuit for stand 1, the circuits for all stands being similar. Magnetic amplifiers and control exciters govern the main generator excitation to give the fine degree of control and speed-dependent regulation required for a mill of this type rolling such thin gauges.

The main mill speed control is carried out from four push-buttons, " thread," " run," " hold " and " stop," which are repeated on the various cabinets on the mill. The control operates through the motorised mill master control rheostat on to the field of the reference exciter. A selector switch gives choice of thread speed, while other push-buttons on some of the cabinets allow " lower " and " raise " speed when it is required to reach intermediate speeds without the use of the " hold " push-button, " weld " speed when speed reduction is required to allow a welded coil to pass through the mill, and " slow stop " when it is desired to stop at a slower rate than is given with the normal " stop " push-button. The main stand motor fields are supplied from a separate exciter, the field of which is controlled by a motor-operated rheostat. Careful consideration has been given to the grading of these rheostats in order that the effect on rolling may be always the same whether the motor is on full field or weak field.

The coiler motor voltage is controlled to be equal to the voltage of the pilot exciter driven by stand 5 motor. These two voltages are compared by a magnetic amplifier, which then supplies one of two fields of the coiler motor, the second field being supplied from a constant voltage exciter controlled by a motorised rheostat. The control is such that the coiler motor field is strengthened as the coil builds up and also provides inertia compensation for changes in mill speed.

Although it is not directly connected with the mill control, further reference must be made to the automatic excitation control equipment for the main motor-generator set synchronous motors. A network of metal rectifiers and resistances is supplied from potential and current transformers in such a way that the output is proportional to the reactive kVA in the synchronous motor supply. The output is applied to a magnetic amplifier which feeds the synchronous motor field. This system can be set up so that unity power factor is maintained by the synchronous motors or they can be made to run with a fixed reactive kVA input. It is possible to run the motors if required without automatic control and without the magnetic amplifiers, by taking a supply direct from the constant voltage exciter for the synchronous motor exciters.

After rolling in the five-stand mill the strip is cleaned to remove the palm oil used on the rolls, and is then annealed.

Temper is given in the new two-stand temper mill before the tinning operation. The drive for this mill is arranged as shown in Table II.

The motors are supplied from a 3,000 h.p. synchronous motor-generator set in which two paralleled main generators feed six of the motors, while separate generators feed the reel motors. A booster set permits individual armature voltage trimming of the six main motors, while excitation is provided from a main exciter set and control exciter set. Magnetic amplifier control is used for most of the control functions, the amplifiers and contactor control gear being similar to those on the five-stand mill.

The control system as a whole needed very careful designing to ensure that it would meet fully the special operating problems of a high-speed two-stand temper mill. The main feature of temper rolling as distinct from cold reduction on a five-stand mill is that the strip experiences hardly any change in thickness while being subjected to very high tensions.

The pay-off and winding reels provide sufficient strip tension for satisfactory uncoiling and coiling but for temper rolling the tension is augmented by the tension rolls on both sides of the mill. There are thus six tensioning drives on the mill, and these all have to work in unison, compared with only one tensioning drive on the five-stand mill. Furthermore, the two rolling stands can be so trimmed in operation that the inter-stand tension is kept to a desired value. This control was specially designed not only for manual and automatic operation, but also for smooth change-over from one to the other at reasonable rolling speeds.

The control systems for the six tensioning drives are similar to those of the five-stand mill coiler but are necessarily complicated by the operational sequences required between tension rolls and reels. The stand motor control systems provide special load-dependent regulating features, into which circuits the automatic inter-stand control system works.

TABLE II.—DRIVE FOR TWO-STAND TEMPER MILL

	Output h.p.	Speed range r.p.m.
Pay-off reel	300	185/835
Bottom tension roll	250	735/1,100
Top tension roll	500	735/1,100
Stand 1	1,000	700/950
Stand 2	1,000	700/950
Top tension roll	500	735/1,100
Bottom tension roll	250	735/1,100
Winding reel	300	185/835

I.E.E. Wiring Regulations

REPLIES to selected inquiries made to the Institution of Electrical Engineers regarding the interpretation of certain of the Regulations for the Electrical Equipment of Buildings (13th edition) were summarised in the *Electrical Review* of 14th September. A second group of interpretations has now been issued by the Institution and from them those of most general interest are summarised below.

Although Regulation 114 (B) (ii) prescribes the use without exception of 7/·029 cable throughout ring circuits, a spur of such cable may be terminated in a spur box, from which a cable having smaller conductors may be run to a clock connector protected (Reg. 108) by a fuse in the spur box. Clock connectors capable of accommodating 7/·029 cable are available and include a type specifically designed for ring circuits.

Bonding of pipes of other services to the earth-continuity conductor is called for (Reg. 214 (B) and 404) only where segregation of the earth-continuity conductor from it is impracticable. The connection of the earthing lead of an installation to a metal water pipe (409 (C)) would not preclude segregation of the earth-continuity conductor in the remainder of the installation (214 (B)). The means of jointing an immersion heater to a water tank is not generally reliable for effective segregation or bonding; bonding by separate conductor is normally needed. Connection to the earth-continuity conductor of the earth terminal of an electric water heater complying with B.S. 843 would normally satisfy the requirements.

The shell of a three-phase or low-voltage electrode boiler, installed in accordance with Reg. 322, can be connected to the supply neutral as well as to the earthing lead by a single conductor between the earthing terminal of the boiler and the associated switchboard, where it must be connected both to the neutral of the incoming cable and to the consumer's earthing lead. This conductor should be of the same cross-sectional area as the phase conductors and the cable sheath and armour should be bonded in parallel with it. The question of whether a flush-pattern switch mounted on a switchbox should be earthed by reason of Exemption (V) to Reg. 403 depends on its being screened by non-conducting material. This point is receiving further study with a view to its treatment in a future edition of the Regulations.

The requirement of Reg. 405 (D) that the earth-continuity conductor in a room containing a fixed bath should be not smaller than 7/·036in or the equivalent applies to the portion within the bathroom that does not form part of a composite cable, which itself provides some mechanical protection. An earth-continuity conductor of this size need not be extended to the consumer's earth terminal, but it must comply with Reg. 407 (B) which refers to Tables 4 and 5. If a water pipe forms part of the earth-continuity conductor the requirements of Reg. 407 (B) (v) must be observed. In regard to risk of corrosion when, for example, a 1/·044in conductor in a composite cable is used for earthing an appliance in a bathroom, attention is drawn to the requirements for periodical inspection and testing (Reg. 511). The foregoing does not refer to protective-multiple-earthing installations, for which conditions are imposed by the Minister of Fuel and Power.

International Vocabulary

A FURTHER section of the second edition of the International Electrotechnical Vocabulary has been published. Known as Group 16, it deals with protective relays and is the eighth of 22 groups to be contained in the completed volume. It includes in its 46 pages 180 terms and definitions under fourteen headings in English and French and terms only in six other languages, each language having its own index. Five groups already published deal with fundamental definitions, electronics, machines and transformers, static convertors and transductors and sixteen more are in preparation. The present document is obtainable at 6 Swiss francs from the I.E.C., 1, rue de Varembé, Geneva, Switzerland.

Deriving Impedance from Admittance

Simple and Direct Slide Rule Method

By T. H. BARTON, Ph.D., B.Eng., A.M.I.E.E.*

ELECTRICAL engineers frequently have need to derive an impedance from an admittance and vice versa. The mathematical details of this operation, the inversion of a complex number, are shown by equation 1 which gives the relationship between the admittance $G - jB$ and the impedance $R + jX$ of a circuit element.

$$G - jB = \frac{R}{R^2+X^2} - j\frac{X}{R^2+X^2} \quad .. \quad .. \quad .. \quad (1)$$

Five separate mathematical operations are involved in the inversion, four multiplications and one addition, and the results of three of these computations must be noted. Thus, the procedure is tedious, it cannot be performed wholly on a slide rule and there is the possibility of error in noting the values of the intermediate stages. Nomograms† and special slide rules with two dimensional scales‡ are available which considerably simplify the computation. However, these methods suffer from a lack of accuracy when the phase angle of the impedance is close to zero or 90 deg, a condition frequently encountered and often requiring accuracy. The following describes a method which, by the use of one extra single dimension scale, enables the whole calculation to be performed on a slide rule in one or two settings, with no intermediate values to be noted, and with high accuracy under all conditions.

The method is based upon the fact that the inverse of a complex number may be written as a function of either one of the components of the number and their ratio. Thus, the equations of interest to the electrical engineer may be written as equations 2 to 5.

$$G - jB = \frac{1}{R}\left\{\frac{1}{1+K^2} - j\frac{K}{1+K^2}\right\} \text{ if } K = \frac{X}{R} \quad .. \quad (2)$$

$$\text{or} \quad = \frac{1}{X}\left\{\frac{K}{1+K^2} - j\frac{1}{1+K^2}\right\} \text{ if } K = \frac{R}{X} \quad .. \quad (3)$$

and

$$R + jX = \frac{1}{G}\left\{\frac{1}{1+K^2} + j\frac{K}{1+K^2}\right\} \text{ if } K = \frac{B}{G} \quad .. \quad (4)$$

$$\text{or} \quad = \frac{1}{B}\left\{\frac{K}{1+K^2} + j\frac{1}{1+K^2}\right\} \text{ if } K = \frac{G}{B} \quad .. \quad (5)$$

The ratio K can have any numerical value, but, by correct choice of one of equations 2 to 5, its value may be restricted to lie within the range zero to unity inclusive. This restricts the value of $1/(1+K^2)$ to the range unity to 0·5 inclusive and the value of $K/(1+K^2)$ to the range zero to 0·5 inclusive. The values of these latter two quantities may, therefore, be graphically plotted as functions of K to provide a ready means of performing the inversion. However, it is much more convenient to engrave on the slide rule two new scales whose lengths are proportional to the logarithms of $1/(1+K^2)$ and $K/(1+K^2)$, but which are labelled with the appropriate values of K. Since these scales cover different ranges, coinciding only when K is unity, they can be combined into one scale whose appearance relative to the normal C scale is shown in Fig. 1. Since the logarithm of a small number is a large negative quantity it is not possible to accommodate the whole of the $K/(1+K^2)$ scale on the slide rule. However, a normal rule will take the scale down to K=0·1 and, as will be shown later, a simple procedure is available for performing the calculation when K is less than 0·1.

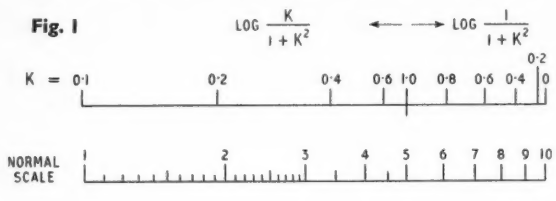


Fig. 1

The use of the rule is best demonstrated by considering a particular example, in this case the inversion of an impedance having R greater than X. The lower scale on the slide will be referred to as the C scale and the lower scale on the stock as the D scale.

(i) Since R>X use equation 2 and set R on the C scale opposite the one (or ten) on the D scale. The reciprocal of R is then on the D scale opposite the ten (or one) of the C scale. The value of K is found on the D scale opposite the value of X on the C scale.

(ii) Keeping the slide stationary, move the cursor over the value of K on the $1/(1+K^2)$ scale. On the D scale, under the cursor line, is the value of the conductance, G.

(iii) Still keeping the slide fixed, move the cursor over the value of K on the $K/(1+K^2)$ scale. On the D scale, under the cursor line, is the value of the susceptance B.

It may be necessary during the calculation to move the slide so that the value of R, originally opposite the one (or ten) on the D scale, is now opposite the ten (or one) on the D scale.

Obvious minor modifications apply to the above instructions whichever of equations 2 to 5 is used. If K is less than 0·1, $\log(K/1+K^2)$ will fall outside the range of the normal slide rule slide. However, for these small values, $\log(K/1+K^2)$ may be replaced by $\log K$ with very little error. Thus, if K is less than 0·1 instruction (iii) must be modified to:—Still keeping the slide fixed, move the cursor over the value of K on the C scale. On the D scale, under the cursor line, is the value of the susceptance B.

The error entailed by this procedure is very nearly directly proportional to K^2, the answer being one per cent high when K=0·1. Thus it is negligible for most engineering purposes but, where a higher degree of accuracy is required, it is only necessary to subtract $(10K)^2$ per cent from the result to obtain an answer whose accuracy is better than 0·01 per cent, i.e., much greater than that of the slide rule. A mathematical statement of the approximation is as follows:—

$$\frac{K}{1+K^2} = K\{1 - K^2 + K^4 - K^6 \ldots\ldots\ldots\ldots\}$$

Thus K is larger than $\frac{K}{1+K^2}$ by

$$100\,(K^2 - K^4 + K^6 \ldots\ldots\ldots) \text{ per cent}$$

Hence when $K = 0{\cdot}1$ the error is $+ 0{\cdot}99$ per cent, when $K = 0{\cdot}05$ the error is $+ 0{\cdot}25$ per cent and when $K = 0{\cdot}01$ the error is $+ 0{\cdot}01$ per cent.

By subtracting $(10K)^2$ per cent from the result the error is reduced to $- 0{\cdot}01$ per cent when $K = 0{\cdot}1$.

* University of Sheffield.

† "'Diamond Seven' Chart for Electrical Computation." A. Pen-Tung Sah, *Electrical World*, 29th September, 1945, p. 101.

‡ "A New Vector Slide Rule," by E. Friedlander, *G.E.C. Journal*, April, 1953.

Water-Cooled Alternator Windings

SUCCESSFUL SYSTEM DEVELOPED BY METROPOLITAN-VICKERS

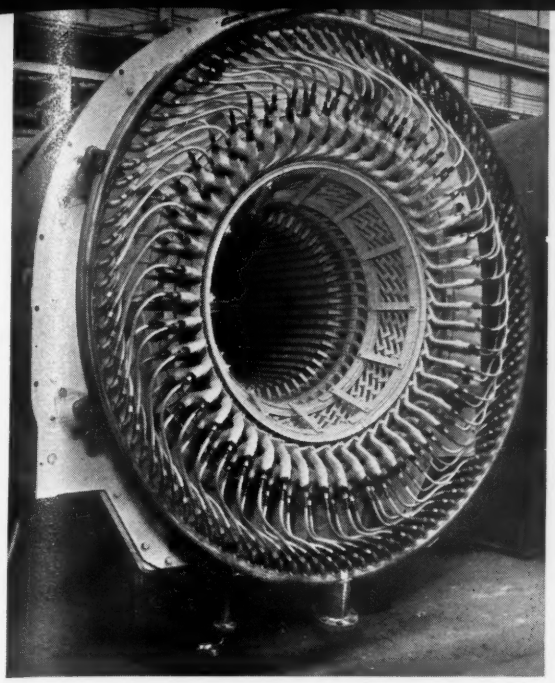


Fig. 1.—The stator of a 30 MW 11·8 kV turbo-generator with direct water cooling

THERE has been no major development in the design of alternators since hydrogen cooling was introduced some years ago. This enabled the physical size of large capacity machines to be kept within manageable proportions and led to the extended use of 60 MW and 100 MW boiler/turbine/alternator units in base load generating stations throughout the country. Generating stations of this size are now comparatively commonplace and in the quest for higher thermal efficiency of operation capacities of 200 MW and even up to 550 MW are to be built for the Central Electricity Authority.

Recognising that this trend in development would take place the Metropolitan-Vickers Electrical Co., Ltd., has investigated various methods of alternator cooling in an attempt to produce very large capacity machines which are of reasonable physical size and can be transported from the factory to the site and subsequently erected without undue difficulty. As a result of all this work the company has now successfully produced a prototype 30 MW alternator with direct water-cooled stator windings. This 11·8 kV 3,000 r.p.m. machine has its stator windings water cooled by circulating water through the coils, the water being in contact with the live copper.

This represents a major achievement and will enable turbo-alternators to be made for even larger outputs than at present without increasing the dimensions beyond the limits of transport. For instance, the cooling system enables the copper requirement to be reduced to about one-fifth of that normally required in a conventionally cooled machine for a given output. Thus, if the shaft and bearings of a machine were suitably designed an output of about 150 MW could be obtained from a machine of the present 30 MW frame size.

The machine, which we recently had the pleasure of inspecting at Trafford Park, is to be installed at the Bold (St. Helens) generating station of the Central Electricity Authority. With the agreement of Mr. A. R. Cooper, controller of the North West, Merseyside and North Wales Division of the C.E.A., it is being supplied in place of one of the four Metropolitan-Vickers standard 30 MW air-cooled generators ordered for Bold. Two of the last-mentioned sets have already been installed, and with the exception of its water-cooled winding the third generator is an exact duplicate, the winding having been designed to fit into the same size stator core and slots.

The operation of the generator under ordinary power station conditions will provide information to further the development work now in progress on the design of the largest generators likely to be required in the future.

Fig. 1 shows the generator stator with the cooling water connections in position prior to a test at approximately full kVA at Trafford Park. The flow of water is from one end of the machine to the other through all the conductor strands in parallel. Water flows from an annular header pipe at one end of the stator, passing through separate tubes of plastics insulating material connected to each conductor. Similar tubes at the other end of the stator convey the water to an annular outlet header pipe.

Fig. 2 shows a section through the stator conductors of the conventionally cooled winding of the two machines already installed in Bold station, and a section through the water-cooled winding with hollow tubular strands which are transposed to reduce eddy currents. The complete water circuit, with duplicate pumps and coolers, strainer, flow alarm, water temperature indicator, temperature alarm and conductivity meter, is shown in diagrammatic form in Fig. 3. The water circuit is supplied from a header tank above the machine, with a float level alarm for detecting leaks.

Standard works tests, using distilled cooling water with a conductivity of 2·5 reciprocal megohms per centimetre cube, were carried out, including open and short circuit

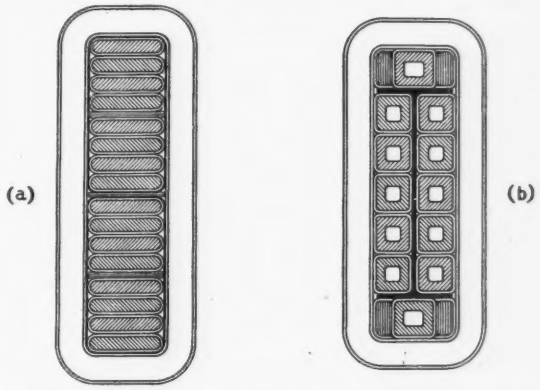


Fig. 2.—This drawing shows (a) a section through a stator conductor of a Metropolitan-Vickers turbo-generator with conventional cooling, and (b) a section through a stator conductor of the machine with direct water cooling

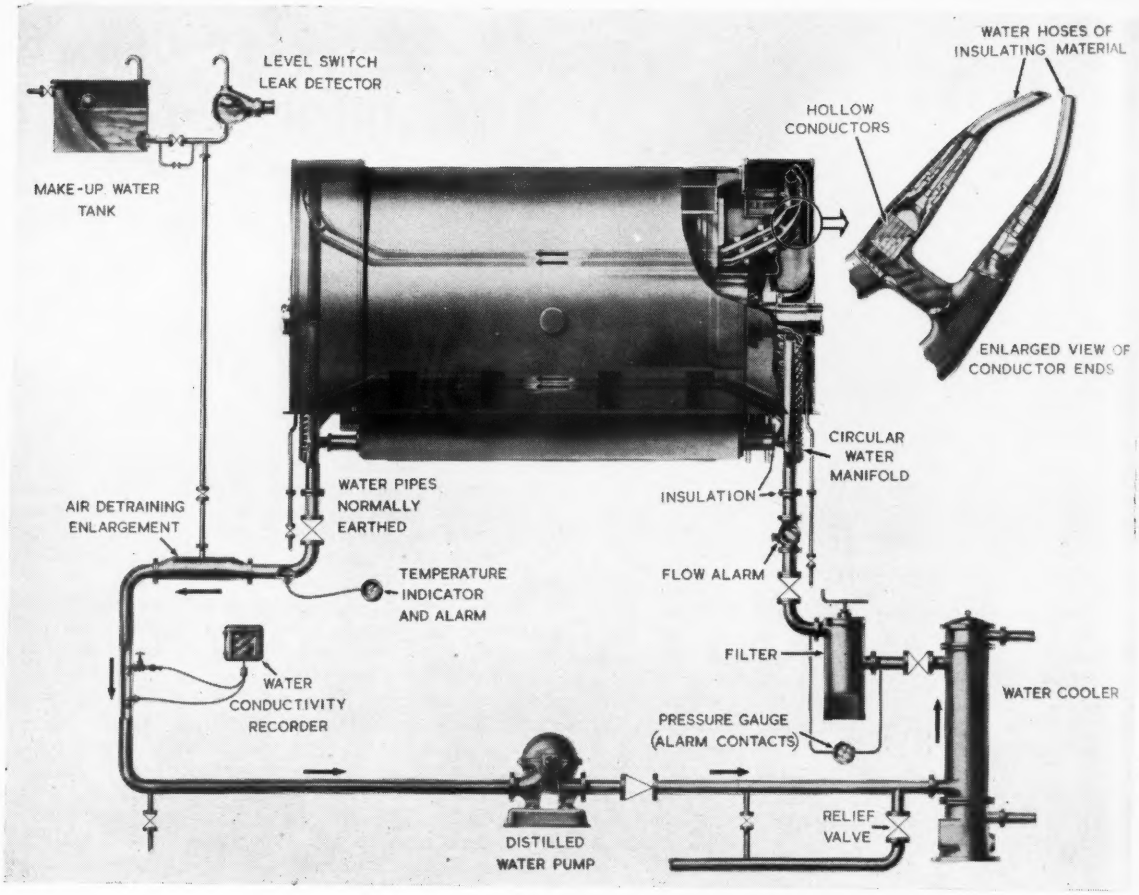


Fig. 3.—Complete arrangement of the alternator stator winding cooling water system

characteristics and losses, followed by a five-hour temperature test at approximately full rated load of 37·5 MVA, 11·8 kV, and zero power factor. The total loss in the water in the plastics tube connections at this load is estimated to be less than 1 kW, and even if Manchester tap water were used the loss would not exceed 10 kW.

During the above test the maximum temperature rise of the distilled water was 2 deg C, and the copper rise would only exceed this by the water to copper surface rise, which is only 0·2 deg C. The power to pump the water through the complete circuit was only 8·8 kW, with a pressure drop across the winding of 18 lb/sq in. These tests were followed by a sudden three-phase short-circuit test at full voltage, and a final high potential test of 24·6 kV for one minute between phases and to earth with water flowing through the conductors.

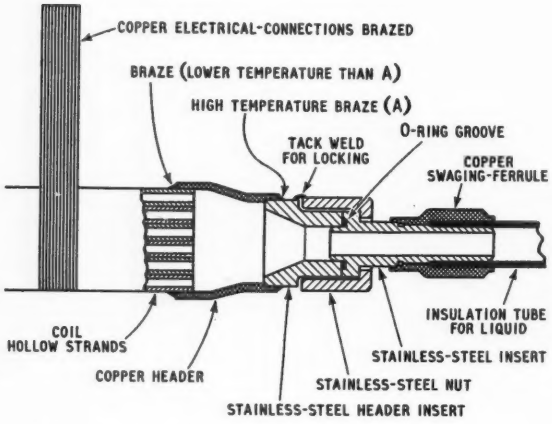


Fig. 4.—Section through a water-cooled stator coil end connection

This new development is a great advance in the direction of reducing the space required for the accommodation of the stator conductors, and therefore in reducing the size of this type of machine. Conductor " A " in Fig. 2, which is the conductor fitted in the stators of the existing 30 MW conventionally cooled generators at Bold power station, has a temperature rise of about 65 deg C measured by thermocouple between coils outside the insulation, for a current loading of 1,835 A, and with cooling air at 35 deg C. The corresponding copper temperature is estimated to be about 115 deg C. The water-cooled conductor " B " in Fig. 2 carried a current of 1,750 A for five hours, after which the copper temperature was 29·2 deg C, the inlet distilled water temperature being 27 deg C. It is therefore capable of carrying a very much larger current within the permissible temperature limits for the insulation in contact with the copper.

Developments of this nature in alternator cooling systems are essential if unit generators exceeding about 200 MW capacity are to be constructed within the present limits of transport in this country. The consulting engineers for Bold power station are Messrs. Merz & McLellan.

Improving Mining Equipment

Central Engineering Establishment of the National Coal Board

SOME time after nationalisation of the coal industry in this country it became apparent that there was a pressing need for the National Coal Board to have a testing and development station solely for its own use. In the past the mining industry had relied almost entirely on manufacturers for the development of new kinds of mining machinery, but to-day they have a heavy load of normal production and are naturally influenced by commercial considerations which make them hesitant to commit scarce resources to the development of new machines until assured of a firm market. There was also an obvious need for a centre where the testing of new equipment and new materials could be carried out, and for the establishment by careful trial and experiment of standard testing procedures and approved specifications of performance under test. Facilities were also needed for testing equipment which had failed in service.

In June, 1952, the National Coal Board approved in principle the setting up of a station to carry out the duties referred to above, to be known as the Central Engineering Establishment. Control of the establishment was to be in the hands of a director, an engineer, who would be responsible to the chief engineer at headquarters. A site was chosen at Bretby in South Derbyshire on National Coal Board property and last week we had the pleasure of visiting the establishment and seeing some of the work which is being done.

The work of the establishment is organised into six departments, the respective functions of which are development engineering, projects, proving and acceptance, workshops, special projects, and administration and finance. When it is completed and all the test equipment has been installed the establishment will have cost about £900,000.

The primary objectives of the establishment are to develop existing equipment and to design and produce prototypes of new equipment and components. Technical specifications and designs of new machines will be prepared, enabling alternative sources of manufacture to be exploited. British manufacturers of mining machinery will be encouraged to speed up development and introduce new techniques. Equipment produced under the development programme and also equipment from outside sources will be proved, and standards and methods of acceptance testing to be used by the Board will be evolved. Acceptance trials of equipment in the pre-production and production stages will also be carried out. In essence, the establishment will attempt to improve the efficiency of mining in this country and will be of the utmost assistance not only to the National Coal Board, but also to mining equipment manufacturers.

A large number of investigations are at present being carried out at Bretby and among those which will be of particular interest to electrical engineers is an automatic control circuit for governing the haulage speed of a coal cutter which has two cutting heads. This equipment ensures that the haulage speed is such that the cutting heads are used with the maximum power available. The cutting heads are driven by separate motors and the control equipment continuously monitors the power consumed by each and controls the haulage by whichever is loaded the most and so tests the haulage speed, so that this motor is then loaded at its continuous rating. Another investigation which is being made is in connection with the possibility of using reinforced plastics in place of some of the hazardous alloys which were recently expelled from British pits. The most promising materials have been found to be of the glass fibre reinforced polyester resin group and some experimental flameproof enclosures have been made.

Any piece of electrical equipment for use underground has to be certified either as being intrinsically safe or as a flameproof enclosure. It has been the practice in the past to aim for intrinsic safety in light current equipment. However, it is almost impossible to achieve an intrinsically safe selective telephone calling circuit without recourse to electronics and in this connection the coal mining industry is at a disadvantage since thermionic valves are not at present allowed underground, unless they are sealed in flameproof enclosures. Thus, a direct contradiction exists between the aim and its achievement using existing equipment. The advent of the transistor has made further development possible since it is likely to be declared safe for underground use provided due attention is paid to the circuitry. In the selective calling system which is being developed at Bretby a Wein bridge oscillator using transistors instead of valves is used as the calling agent. It is capable of being switched to any one of eight frequencies, has no warming-up period and can be operated from a 12 V mining type signalling battery. Thus, up to eight stations may be connected to one pair of lines. The receiving agent is a simple series resonant circuit using a capacitor and a high Q inductance. The voltage developed across the inductance at resonance is used via a transistor impedance changer to actuate the ringing relay which in turn operates the signal bell.

Air Conditioning

THE Alfred Bossom Lecture was delivered before the Royal Society of Arts on 28th November by Mr. J. S. Hales (British Coal Utilisation Research Association), who took as his subject "Air Conditioning of Buildings." This term covered the control of temperature, humidity, cleanliness and distribution of the air under two headings—for personal comfort and for manufacturing processes. Mr. Hales said that in the U.S.A. the yearly increase in sales of residential types of air conditioning plant amounted to about 50 per cent, and units were now installed in 3 million out of 45 million homes. In Great Britain the increasing sizes of office blocks often made air conditioning desirable for many reasons, including air filtration and exclusion of noise. In industry, precision manufacture of specialised goods called for greater control over temperature and humidity. A degree of variability was sometimes recommended to sustain a more stimulating atmosphere and in other cases the inside temperature was allowed to rise in sympathy with that out of doors.

Principles underlying different modern designs were described and the need for co-operation between architects and heating engineers at an early stage of planning buildings was emphasised. Where refrigerating plant was already installed for cooling the case for the use of heat pumps was greatly improved.

NEW BOOKS

Electricity in the Textile Industries. By W. E. Swale, M.I.E.E., A.M.I.C.E. Pp. 244; figs. National Trade Press, Ltd., Drury House, Russell Street, London, W.C.2. Price 30s.

The author set himself the task of writing an electrical engineering textbook dealing with all aspects of electricity in the textile industry in as simple a manner as possible. He has achieved his object so well that this book will be especially useful to accountants, managers or directors in the industry, apart from its obvious value to members of the actual works engineering staffs.

The book not only shows how electrical power reaches the factory and is distributed but it also explains in a very simple and clear way the meaning of such electrical engineering terms as power factor, kVA, reactance, capacitance, etc., and it also deals with basic mechanical terms. The various types of electric motors and starters are dealt with in a similar manner. The chapters headed Private Generation of Electricity, Leads, Instruments and Meters and Conditions of Supply and Tariffs give a great deal of essential information from the economic point of view.

There is a chapter dealing with the basic design features of the average consumer's type of substation and a well-informed section on the consumer's distribution system. Other sections cover the application of electric motors to spinning and weaving, wool, flax and jute and there is a brief note on safety regulations. Only nineteen pages are devoted to the three chapters on works lighting, heating, ventilation and air conditioning, and mechanical handling, cleaning and amenities, and it will be appreciated that the author has only touched the fringe of these subjects, but there is a useful list of references at the end of the book.

This work covers a wide range of subjects, it does not become too technical, and the author has a refreshing approach to the basic engineering terms and problems associated with textile production.—F.B.C.

Calder Hall. By Kenneth Jay. Pp. 88; figs. 9; plates 16. Methuen & Co., Ltd., 39, Essex Street, London, W.C.2. Price 5s.

Calder Hall nuclear generating station has probably received more publicity than any other industrial plant which has been constructed during this century, and quite rightly so, for it has an importance to industry to-day equivalent to that which the reciprocating steam engine had when it was invented in the last century. This little book describes the broad principles upon which nuclear power generation is based in a simple and easily understandable manner. It is intended primarily for the layman, but it will also be of interest to those many engineers who have so far not themselves been directly concerned with the subject but are likely to be during the next decade when the Central Electricity Authority's programme of nuclear power station construction gets under way.

The reviewer feels that the publishers' claim that the book contains the first full description of Calder Hall is an exaggeration. After all, there is less than one page dealing with the turbine room installation. The book is not intended to be a serious technical work but to provide a simple explanation of the principles upon which the world's first large-scale nuclear generating station is based.—R.P.

Electronic Computers. Edited by T. E. Ivall. Pp. 167; figs. 40; plates 28. Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 25s.

Electronic digital and analogue computers are not particularly simple equipments to understand and their potential applications are not nearly so well comprehended as they should be, particularly by business executives. Much of this book will be of interest and value to the latter since it contains a broad picture of the whole field of computing; sufficient, in fact, to enable the executive to decide whether and how a computer can be of material assistance to him in his business. The treatment is non-mathematical although for a deeper understanding of the subject a knowledge of electricity or electronics would be helpful. The book has been purposely made to have a general character to give the reader a broad foundation on which he can base more advanced and specialised studies.

Both digital and analogue computers are dealt with and comparisons are made between the two types. The majority of the book is devoted to describing their circuitry and construction, while their rapidly developing applications in commerce, industry and science are also outlined. In this section of the book considerable emphasis is placed on the application of computers to so-called automation techniques in industry, and also on the use of analogue computers as simulators or "models" of control systems. The final chapter deals with the possible lines of development which computers are likely to follow in the future. Altogether this is a most useful book and it will undoubtedly be of great value to engineers, technicians, students and business executives alike.—R.P.

BOOKS RECEIVED

Electrical Machines. By A. Draper. Pp. 346; figs. Longmans Green & Co., Ltd., 6 & 7, Clifford Street, London, W.1. Price 40s.

Nuclear Energy in Industry. By J. G. Crowther. Pp. 168; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 17s 6d.

Electro-Technology for National Certificate Courses. Vol. II. By H. Buckingham, M.Sc., Ph.D., and E. M. Price, M.Sc.Tech. Pp. 298; figs. The English Universities Press, Ltd., 102, Newgate Street, London, E.C.1. Price 12s 6d.

Electrical Engineering (General). By A. T. Dover, M.I.E.E., and F. T. Chapman, D.Sc.(Eng.), M.I.E.E., with F. Brailsford, Ph.D., B.Sc., M.I.E.E., and Harley Carter, A.M.I.E.E. Pp. 489; figs. Longmans Green & Co., Ltd., 6 & 7, Clifford Street, London, W.1. Price 50s.

Linear Transient Analysis. Vol. II. By E. Weber. Pp. 452; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 84s.

Metallurgical Analysis by Means of Spekker Photoelectric Absorptiometer. 2nd Edition. By F. W. Haywood and A. A. R. Wood. Pp. 292; figs. Hilger & Watts, Ltd., 98, St. Pancras Way, Camden Road, London, N.W.1. Price 40s.

Introduction to Electrical Applied Physics. By N. F. Astbury, M.A., Sc.D., M.I.E.E., F.Inst.P. Pp. 241; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 36s.

Radio and Electronic Components. Vol. III. Fixed Capacitors. By G. W. A. Dummer, M.B.E., M.I.E.E. Pp. 260; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 45s.

Computers—Their Operation and Applications. By Edmund C. Berkeley and Lawrence Wainright. Pp. 366; figs. Reinhold Publishing Corporation, New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 64s.

Floor Warming in Glasgow Flats

LAST week Mr. J. Nixon Browne, Joint Parliamentary Under-Secretary of State, Scottish Office, opened two new ten-storey blocks of flats, erected by the Scottish Special Housing Association, Ltd., at Toryglen, Glasgow. To take advantage of lower electricity tariffs, in each living room, kitchen and hall the "Panelec" embedded floor warming system has been installed, arranged for off-peak operation. The total loading for the two blocks is 170·76 kW, averaging 2·84 kW per flat.

VIEWS on the NEWS

By REFLECTOR

TO-MORROW (Saturday) the Piccadilly Tube celebrates its jubilee; the original line, from Finsbury Park to Hammersmith, was opened by Mr. Lloyd George, then President of the Board of Trade, on 15th December, 1906. The original powers for a shorter line following part of this route (Piccadilly Circus to South Kensington) were granted in 1897 but it was not until the American financier Charles T. Yerkes and his associates acquired the rights that work was actually begun—in 1902. Most of the original rolling stock was supplied by two foreign companies, French and Hungarian, and two of the French cars were in use, on the Aldwych shuttle service, until July last. There were only two British cars, but they were the first of the all-steel type to be built in this country. In its first full year (1907) the Piccadilly Tube carried 14 million passengers.

* * *

One result of the oil shortage has been to induce the Liverpool City Council to call a conference of "interested parties" to consider whether and how the Liverpool Overhead Railway can be kept in being. Because of high repair and maintenance costs the Liverpool Overhead Railway Co. has obtained sanction to the closing-down of the line at the end of the year. It is said that this would cause an influx of 30,000 passengers a day into the city's transport services and to meet this demand the Corporation proposed to put on extra diesel-engined buses. This is naturally undesirable for the present and probably for the future too and so it is to be hoped that the funds will be found for putting the overhead railway in order and keeping it going.

* * *

In September it was proposed at a meeting of the Glasgow City Council that the scrapping of the trams, already decided upon, should be speeded up. Wisely, the Council rejected the proposal in view of the possibility of petrol rationing, which has now been instituted. Glasgow still has over 800 trams left in its system which was once one of the largest, cheapest and most efficient in the world. Glasgow's rival city, Edinburgh, said farewell to its last tram a week or two ago. Maybe, like the prima donna's, this farewell may turn out to be not quite final.

* * *

Lloyds of London are famous for their willingness to underwrite practically any kind of risk—for a suitable premium—in almost any part of the world. The Puget Sound Electric Power & Light Co. which operates hydro-electric plants on the Columbia and other rivers of the North-West United States feared that the water volume might be inadequate to its needs during the coming winter and that it would then have to have recourse to the more expensive steam-generated power. It has happened to American hydro-electric operators before, when they have had to impose a surcharge for the dearer power. Now the Puget Sound Company has arranged a policy with Lloyds by which the company will bear the first $100,000 of the extra expense while the underwriters will be responsible for any further cost up to $800,000.

* * *

A report in the *News Chronicle* states that an experimental installation of sixpence-in-the-slot electric shavers in a number of London public houses, hotels and clubs has proved so successful that a company is being formed to launch them nationally. Is the time coming, I wonder, when the phrase "I just dropped in for a quick one," will refer to a visit to a hostelry for a shave and not for refreshment? Howbeit, I feel that the consumption curve of the C.E.A. as a result will not rise so steeply as that of the brewers.

* * *

Vehement protests against the use of electric-discharge lighting are common but seldom so fierce as those from St. John's Wood, London. There an official of the local Preservation Society is reported by the *Manchester Guardian* to have said that the "appalling act" of installing sodium lighting in the district was the signal for "war to the death." The edge was taken off this rather by her subsequent explanation that this meant presenting a petition at the town hall.

* * *

In my last week's note on London trolley-buses I said that the London Transport Executive had ordered 15,000 diesel-engined buses. This was a gross exaggeration—the actual number is 1,500.

* * *

Many inventions in modern use are much older than is generally thought; some of course have been resuscitated after a long period of desuetude. I suppose that this consideration applies in the case of the telegraphing of photographs which was mentioned eighty years ago—in the *Electrical Review* of 15th December, 1876—in the following terms:—

> "The Paris correspondent of the *Standard* says some inventor has found out a means of sending portraits by telegraph. The *modus operandi* has not yet been disclosed, but experiments have been made by the police authorities of Paris and Lyons, and, it is said, with complete success. The portrait of a Lyons official was forwarded from Paris by the new telegraphic apparatus, and at once recognised. In return, the Lyons police telegraphed to Paris the portrait, accompanied by the usual description, of a clerk who had just absconded with his master's money, and the Paris police were enabled, thanks to the telegraphic portrait, to arrest the thief on his alighting from the train at the Lyons railway station. Various other applications of this invention will suggest themselves."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Standards, Not Numbers

TECHNOLOGICAL education in this country to-day seems to be condemned by lecturers and writers compared with America and the U.S.S.R. on the relatively greater number of graduates in these two countries (*Electrical Review*, 30th November, page 996). Don't let us be bullied by numbers. They don't mean a thing.

No one stops to examine the standards of graduation in the different countries. The average American college graduate to-day is two years behind the British university graduate. This is attested by all those who have taken part in exchange teaching in the two countries. The American graduate is just up to the standard of the top forms of public and good secondary schools in England.

From the Russian figures given in your article, and from other sources, it seems clear to me that the Russian technologists are one to two years behind even the Americans. Their graduates, as has been testified by experienced educationalist visitors, are not, in our sense, professional men at all, but make excellent works technicians. Out of the mass of the 10,000 so-called engineers at the Moscow Bauman Institute, there will be a limited number of men of ability who will pursue their studies further and be capable of taking charge of a job like our engineers.

The real problem in Britain is that we do not train enough *technicians*. According to a recent Government report, there should be five or six technicians to one graduate. In fact, anyone looking for technicians will be lucky if he can find two per graduate, and in some places I know of there are three fully qualified men, of our high standards, for one technician.

Our technical achievements have been due to the high standards of our engineers and chemists, not to the adequate, or inadequate, *number* of technicians; though perhaps to-day, owing to increased mechanisation, we really do want more technicians.

Newport, Mon. L. H. CALLENDAR, Ph.D., F.I.M., F.R.I.C.

Fog Illumination

THE A.P.L.E. Conference at Blackpool this year saw the debut of a sodium lighting unit designed for use in street bollards, guard posts, etc., during foggy weather. No doubt you will recall that the apparatus consists of a hand-controlled 45 W sodium vapour discharge lamp which may be switched on at any time during the 24 hours. The weakness of the apparatus lies in the fact that it is hand controlled and I would like to suggest a method for the automatic control of these units.

To ensure that the sodium lamp is on during foggy weather only, the fog itself must be the agent to control the lamp. Air would be circulated by a fan through an air line in the bollard and passed to a control chamber containing a gauze filter, a light-sensitive cell to control the sodium lamp on one side of the filter, and a low-wattage tungsten filament lamp on the opposite side of the filter. The air having passed through the control chamber would be exhausted to the atmosphere. The mesh of the gauze filter would permit the free passage of air containing the normal quantity of airborne dirt, but would prohibit the passage of the large quantities of moisture-laden particles which are a feature of "smog." During normal atmospheric conditions the filter would remain unobscured and light from the metal filament lamp passing through the filter and falling on the light-sensitive cell would ensure that the sodium lamp was not lit. The accumulation of moisture-laden particles on the filter during foggy atmospheric conditions would quickly obscure the filter, preventing light from the tungsten lamp reaching the light-sensitive cell and so causing the sodium lamp to light.

This condition would be maintained so long as the fog prevailed, but as soon as the fog cleared the heat from the tungsten lamp would dry the gauze filter, the air passing through the filter would dislodge the particles of dirt which would collect in a removable tray in the bottom of the control chamber, thus permitting light from the metal filament lamp to pass through the filter and operate the light-sensitive cell to switch off the sodium lamp.

The filter would of course have to be changed periodically and different types of filter would be required for different localities, a heavy duty industrial filter would be needed for London and the Midlands and a light duty filter for the coastal regions, for instance.

The application of the suggestion need not be confined to fog. The Meteorological Office, in their investigations into the effects of smog in the atmosphere, would welcome the opportunity offered to measure the amount of dirt contained in the air in foggy weather, and one can foresee a modification of the apparatus used for traffic control of shipping on the Suez Canal during sand storms.

Hendon, N.W.4. V. F. SMITH.

Prestressed Concrete Dam

AT a recent meeting of the Institution of Civil Engineers Mr. J. A. Banks presented a paper dealing with constructional aspects of the prestressed concrete dam to be built at Allt-Na-Lairige, Argyllshire, for the hydro-electric scheme which will provide 20 million kWh per year. He said the dam would be 1,360ft long and 73ft high and that it would be the first dam to be built in this country by using prestressed concrete. This method of construction would, he said, effect a saving in concrete of 40 per cent, representing a monetary saving of £75 per foot length of the dam.

The novelty of the dam, however, was that it would be anchored to the bedrock of the valley by steel bars. When the concrete mass of the dam had been built to the full height of 73ft round these bars, a pull of 37 tons would be applied to each by jacks, thereby binding the top of the dam to where the bars would be anchored in the bedrock.

This system of anchoring, originally devised for dams by the famous French engineers, Messrs. Coyne and Freyssinet, and already successfully used for heightening existing dams, had led to remarkable savings brought about by the fact that a far smaller volume of concrete was needed to hold back a given quantity of water.

Experience with the Allt-Na-Lairige dam had strengthened the author's opinion that prestressed concrete dams had certain advantages over other types and, in deciding what form of dam was most suited to a particular site, a prestressed concrete design should be considered with others which had been proved successful hitherto.

In this case a gravity type dam could only be built economically to a height of 64ft. As is was, the additional 9ft in height made possible by the new technique would increase the total water storage capacity by a third.

PARLIAMENTARY REPORT

Patents Bill

In the House of Lords the Patents Bill was passed without amendment, although several peers attempted to insert a new procedure to ensure that a person who wanted a patent quickly was not held up unnecessarily. The Government spokesman said that the method proposed would probably operate unfairly and the Government was satisfied with the procedure now in operation. The Bill now goes to the Commons.

Transport Bill

In a debate in the House of Commons on the Transport (Railway Finances) Bill, which provides for £1,200 million for railway modernisation to be raised by loan, Mr. Harold Watkinson, Minister of Transport, referred to the big increases in receipts which had followed the introduction of multiple-unit diesel trains.

He said that by modernisation, the rationalisation of services, increased productivity and by using their greater freedom to charge competitive rates, the Transport Commission estimated that it would "break even" by 1962, but in the meantime the Government had approved a financial plan which would place the finances on a firm basis during the critical years of reconstruction.

Mr. Ronald Russell was disappointed with the rate of electrification proposed by the Commission. He said the highest rate of electrification was to be reached in 1962, at 1,000 track miles a year. The total track mileage of British Railways was 53,000. He estimated that the mileage electrified so far was between 5,000 and 10,000. That left an enormous gap to be electrified, and a rate which envisaged a peak of 1,000 miles a year in 1962 meant that it would take a long time.

He could not help comparing this with the electrification being carried out on the Continent. It was unfair to make the comparison with Switzerland or Sweden, who were neutral during the war, but great progress was also being made in Belgium, Holland, France, Italy and Western Germany. Holland's railways were badly damaged in the war and he appreciated that electrification there had gone hand in hand with completely new equipment. It might not be long before passengers would be able to travel on an all-electric service from the Hook of Holland to Vienna. There was only one gap in Belgium and Western Germany, from Liége to Mannheim, which was not electrified. It represented great progress compared with the period before the war. How long would it be before we were able to travel 400 miles, which was less than half that distance, between London and Glasgow?

Mr. F. McLeavy thought the new diesel services should be made complementary to, rather than competitive with the road services.

Mr. Rupert Speir appealed for the introduction of light diesel cars on the rural lines which had been closed for passenger traffic although goods trains were still kept running. No attempt had been made to make these lines pay by establishing unattended halts, mechanised level-crossing gates and simpler forms of signalling. His impression was that these lines could be turned into rural tramways.

Mr. Skeffington considered it an astonishing decision to standardise on the vacuum brake rather than the air brake. The Commission's own experts had pointed out that the advantages of the air brake increased progressively as the weight and length of trains became greater. The adoption of the vacuum brake, they had said, would prevent any further development in the length and weight of freight trains running at the high speeds which the use of more powerful motive power units following electrification and dieselisation would make desirable. These experts had advised that the adoption of the vacuum brake would be inconsistent with the modernisation plan and with forward-thinking generally. Mr. M. W. Shorter, managing director of the Westinghouse Brake Company, had said that if the air brake had been adopted it would have provided an efficient system at low first cost, and economical maintenance. The decision should be looked at again.

It was disappointing to see no reference in the Commission's plans to any electrification in the Western Region, particularly in the section serving Acton, Ealing, Southall, Hayes and West Drayton. The service was now poor and the people in the area had hoped for some relief through electrification of the line. The Home Counties Electric Traction Society had sent a plan to the Commission, who had replied that it was a practical and feasible plan, without giving any indication that it would be adopted. He made an urgent appeal for this scheme to be considered.

Mr. Norman Cole also appealed for the electrification or dieselisation of the London Midland line from South Bedfordshire.

Mr. Gresham Cooke welcomed the Commission's plans for the mechanical handling of small freight consignments —the installation of power-operated conveyor belts, stillages, power trucks and fork-lift trucks. He could not see why level crossings on branch lines in the rural areas should not be operated by traffic lights, or by gates automatically controlled from a long distance.

Mr. Hugh Molson, Parliamentary Secretary, Ministry of Transport, said the main reason for adopting the vacuum brake was that it would be possible to apply it throughout British Railways sooner than if a new departure had been made and the air brake had been adopted.

Electricity Employees' Pensions

Mrs. Castle asked the Minister of Fuel and Power whether he had yet approved the proposals of the Central Electricity Authority for increasing the pensions of all those in the industry, including ex-local authority pensioners, who retired before 1st April, 1952. She said this matter had dragged on for a long time; the Minister had promised quick and speedy action, but after "chewing over" the proposals for three weeks still no decision was announced.

Mr. Jones said the proposals might have been "chewed over" for a long time by the Central Electricity Authority but his own consideration began when they were submitted to him; he would try to give an answer soon.

Mr. Malcolm MacPherson asked the Secretary for Scotland how soon a decision would be reached on pension increases similar to those provided in the Pensions (Increase) Act, 1956, for pensioners of the Electricity Boards who were formerly employed by local authorities.

Mr. J. Stuart replied that he was still considering this, but a decision would be reached with the least possible delay.

C.E.A. and New Bill

Mr. Jones, replying to Mr. Palmer, said that in formulating the Electricity Bill, the Government took full account of the views of the C.E.A. and the Area Boards.

Mr. Palmer: In view of the fact that many of us are anxious to reach a fair conclusion on the merits of this proposed legislation will the Minister consider making available to the House the views of the Central Electricity Authority and the Area Boards, particularly as the evidence given by the Central Electricity Authority to the Herbert Committee was not published?

Mr. Jones said that that was a question which he could answer only after consultation with the C.E.A. but he wanted to make it quite clear that the Government, and the Government alone, assumed responsibility for the nature of the legislation put forward.

"Packaged" Reactor Stations

Mr. R. A. Butler, Lord Privy Seal, informed Mr. Mason that the Atomic Energy Authority was examining a number of advanced reactor systems, some of which might be particularly suitable for development on a small

scale. (Mr. Mason had asked whether the Authority was giving consideration to the building of "atomic energy packaged stations.") None of the systems was likely to reach the stage of commercial use for some time. He told Mr. Warbey that the second unit at the Calder Hall station would be completed in the autumn of 1958, and the two units at Chapel Cross during 1959.

"Does not this remarkable rate of progress show what might be done in the civil construction of atomic power stations if a similar priority and urgency were given to those?" asked Mr. Warbey. "In view of the great need to replace oil supplies, will the Government see that a similar urgency is given to them?"

Mr. Butler gave an assurance that the Government was giving urgent attention to this point.

Evasion of Hire-Purchase Regulations

Mrs. Jean Mann asked the President of the Board of Trade if he was aware that his credit restriction policy, whereby deposits on hire-purchase specified items had been increased, was being defeated by moneylenders who were prepared to advance these deposits on instalments, and if he would take steps to end this practice.

Mr. Erroll, Parliamentary Secretary, said the Government had no evidence that moneylending as a means to facilitate the payment of hire-purchase deposits was taking place on any significant scale, but investigations were being made into certain transactions where loans were tied to the payment of deposits or advance rentals.

Mrs. Mann asked if Mr. Erroll was aware that a £59 television receiver became a £115 set by a purchaser moving along a few doors and borrowing the deposit from a moneylender.

Mr. Erroll said that if it was what was called a "free loan" from a moneylender there was no objection to it. If, however, it was tied to a hire-purchase transaction it would require investigation.

Training Schemes

Mr. Ellis Smith asked the Minister of Labour what further action was contemplated on the lines of that explained in the foreword of the 1956 Report on Scientific and Engineering Manpower; and what action it was intended to take to improve the educational and training facilities for craft apprentices in the engineering industry and to give more encouragement to them to qualify for Higher National Certificates or Higher National Diplomas.

Mr. Robert Carr, Parliamentary Secretary, said he could not add to what had been said by Government spokesmen earlier about university expansion. As regards apprenticeship the National Joint Advisory Council had instituted an inquiry into the whole question, taking particular account of the fact that in the next few years there would be an increasing number of boys and girls leaving school and going into industry.

When Mr. W. R. Williams complained that large numbers of our best scientists and engineers were receiving attractive inducements to go to America and other countries, and asked what the Government were doing to encourage them to remain to help in the technical training establishments, Mr. Carr said that that was a matter for the Minister of Education.

South West Scotland Development

Mr. Emrys Hughes asked the Secretary of State for Scotland to what extent the supply of electricity in South West Scotland would be increased during the next twelve months under schemes for capital expenditure so far approved.

Mr. Stuart said that new plant with an installed capacity of 60 MW and an expected output of 159 million kWh would come into operation at Barony, in Ayrshire, during the next twelve months.

Electricity Board Salaries

Mr. Palmer asked the Minister of Fuel and Power what action he proposed to take on the recommendations of the Herbert Committee of Inquiry into the electricity supply industry that there should be relativity with outside industry in the matter of the salaries paid to Board chairmen and others.

Mr. Aubrey Jones said that the Government recognised that there was much to be said for a review of the salaries paid to members of the Boards of nationalised undertakings, but he regretted that the financial and economic situation made it impossible for him to make any more definite statement on this matter at present.

Calder Hall Operation

Mr. Mason asked to what extent the Calder Hall power station had been continually producing electricity since it was put on to the national grid and whether it had consistently maintained its output.

Mr. Butler said he was informed by the Authority that, except for periods from 5th to 12th November and 14th to 22nd November when the reactor was shut down for examination, Calder Hall had produced electricity continuously since 17th October. The reactor was being run to capacity and this would continue for some time.

Mr. Jones, Minister of Fuel and Power, declined to answer without notice when Mr. Hobson asked for the cost per kWh from the Calder Hall station. Mr. Hobson alleged that this information was being refused.

Boards' Trading Costs

Mr. McAdden asked the Minister what progress he had made in his consultations about the recommendations of the Herbert Committee regarding the retail trading activities of the Electricity Boards.

Mr. Aubrey Jones, in a written reply, stated that he had now agreed with the industry the changes to be made in the accounts for this part of the Boards' business. In future they would show the receipts and direct costs for their contracting business separately from those for their sales of fittings. The present information in the accounts about indirect costs would not be split in any way, but would be supplemented with estimated figures for the rent, rates, and insurance chargeable to this business.

In addition the Boards would amplify the notes on accounts to include, amongst other points, an estimate of the capital employed in the business, thus making it possible to calculate the net return on that capital. The changes would involve extra work for the industry and he was grateful to the Boards for agreeing to incorporate them in the accounts for the current year.

Gold Coast Development

In the debate on Commonwealth economic development several M.P.s referred to the fact that under the Ghana Bill, which will give independence to the Gold Coast, economic assistance under the Colonial Development and welfare funds would be discontinued. They said it was vital that investment in projects now in hand should be continued after the Gold Coast had obtained independence.

Mr. Walter Elliot returned to this subject in the debate on the economic consequences of the Suez affair. He said that one of the great projects within the Gold Coast which the people there wished to see carried out was the Volta River hydro-electric project. The Government should see that scheme carried out because it was under our ægis that this, the first African state, grew up, and it still looked to us for support.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £272 10s 0d
Fire Refined 99·7%	ton £271 0s 0d
Fire Refined 99·50%	ton £270 0s 0d
COPPER Tubes ..	lb 2s 8d
Sheet	ton £345 10s 0d
H.C. wire and strip ..	ton £309 0s 0d
LEAD, English ..	ton £113 10s 0d
Foreign	ton £112 0s 0d
MERCURY	flask £84 0s 0d
TIN, block (English) ..	ton £808 0s 0d
ZINC, G.O.B. Foreign	ton £99 0s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 2½d
Sheet	ton —
Wire	lb 2s 10⅝d
PHOSPHOR BRONZE Wire	lb 4s 3⅜d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 31½d—31⅝d

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The B.E.A.M.A. Education Committee gave a luncheon to **Sir Arthur P. M. Fleming,** C.B.E., on 28th November on the occasion of his retirement from the chairmanship of the Committee and presented him with an engraved silver cigarette box. He has been the chairman of the Education Committee since its constitution in 1917. The toast to Sir Arthur was proposed by Col. B. H. Leeson, director of B.E.A.M.A., and supported by Mr. C. Grad (British Thomson-Houston Co., Ltd.). Mr. J. O. Knowles, the vice-chairman of the B.E.A.M.A., presided. In his reply, Sir Arthur recalled many memories of his early days in the industry when training facilities were strictly limited and when very little time and thought were given to the education and training of workers in the industry. He compared those days with the interest and activity in educational matters evident to-day, and the urgency with which responsible authorities were pressing the subject.

Mr. R. Dingwall, M.I.E.E., has been appointed deputy chief engineer of Dorman Long (Steel), Ltd. Mr. Dingwall, who has been works manager of the company's Lackenby steelworks since 1953, studied engineering at the Heriot-Watt College, Edinburgh. Following a student apprenticeship with the British Thomson-Houston Co., Ltd., Rugby, he gained experience with the North Eastern Electric Supply Co., Ltd., and the L.N.E.R. on its electrified lines on Tyneside before joining Dorman Long in 1936. After a period at the Cleveland works he became senior electrical development engineer in the Central Engineering Department and later the department's chief electrical engineer (works). Before going to start up the new Lackenby steelworks, Mr. Dingwall was in turn assistant works manager at the Acklam, Britannia and Redcar works of the company.

Mr. R. Dingwall

Mr. J. S. Curphy, M.B.E., F.I.M., has been appointed superintendent of all the company's steel plants. He joined Dorman Long in 1923 on the laboratory staff at the Acklam iron and steel works, being in turn chemist, metallurgist and fuel technologist before being appointed assistant steel plant manager. He later held a similar position at the Cleveland and Redcar works, becoming steel plant manager at the latter works. When the Lackenby steelworks were built Mr. Curphy was appointed manager of the steel plant.

Mr. Henry S. Loebl has notified Laurence, Scott & Electromotors, Ltd., of his wish to retire from the board. He has been a financial director of the company since 1935. **Mr. P. M. Tapscott,** who is in partnership with Mr. Loebl, has been appointed to fill the vacancy. He was educated at Uppingham School and Trinity College, Cambridge, and until recently was a financial officer of the Friends' Provident and Century Life Office.

Mr. Luke Fraser has been appointed London manager of G. & J. Weir, Ltd., as from 1st January next. He was previously the company's Scottish sales representative and this position will now be filled by **Mr. F. T. Randell** from the Cardiff branch office. **Mr. A. C. Smith,** former London manager, has now returned to the head office in Glasgow, as sales director.

Sir George Briggs has joined the board of Thompson Brothers (Bilston), Ltd., as deputy chairman. He is a director of the Brush Group, Ltd., and Thomas Tilling, Ltd., and a member of the Royal Ordnance Factories Board. He is also a consultant to Tube Investments, Ltd.

The Metropolitan-Vickers Electrical Co., Ltd., has appointed **Mr. G. H. Butterworth,** B.Sc., A.C.G.I., A.M.I. Mech.E., A.M.I.E.E., as superintendent, Mechanical Department, in succession to **Mr. A. C. Annis. Mr. A. E. Clayton** has been appointed works manager and **Mr. A. Cormack,** B.Sc.(Eng.), assistant superintendent, both at Germiston Works.

Mr. Butterworth received his technical education at Halifax Technical College and the City and Guilds Engineering College, London. After an electrical apprenticeship with a firm in Halifax he joined M-V as a college apprentice in 1938. Since then he has been in the Mechanical Department, having been appointed production engineer in 1940 and chief production engineer in 1946. He has been assistant superintendent, Mechanical Department, since 1949.

Mr. G. H. Butterworth

Mr. A. E. Clayton

Mr. A. Cormack

Mr. Clayton went to Stretford Technical School and the College of Technology, Manchester. He joined M-V as a trade apprentice in 1935, after which he entered the Mechanical Department, where he became a production engineer in 1943. In 1952 he transferred to the newly acquired Germiston Works (Glasgow) as chief production engineer. Two years later he was appointed engineer-in-charge at Germiston.

Mr. Cormack served with the Royal Signals from 1944 to 1948 and then went to Aberdeen University where he took his degree. He joined M-V as a college apprentice in 1951, and in the following year he was appointed assistant planning engineer, Mechanical Department. In March, 1953, he transferred to Germiston Works, where a year later he became chief production engineer.

Mr. H. H. Lusty, A.M.I.E.E., F.P.I., is to be manager of the M-V Publicity Department as from 1st January. He succeeds **Mr. E. E. Walker,** F.I.A.M.A., who is retiring but will act in an advisory capacity until the end of January.

Mr. Lusty joined Metro-Vick as a trade apprentice in 1919 and subsequently became an Associate of the Manchester College of Technology. After periods in the switchgear drawing office and research department, he left Trafford Park in 1934 to take charge of publicity at Bakelite, Ltd. Two years later he was appointed controller of publicity, and in 1943 he became marketing manager.

Mr. Lusty is at present chairman of the Council of the Plastics Institute, a member of the British Plastics Federation Publicity Committee, and industrial adviser on plastics to the Council of Industrial Design. He is also a member of the Incorporated Advertising Managers' Association. During recent years he has visited the United States and many European countries in connection with the Bakelite's overseas activities.

Mr. Walker, who was born at Redditch, Worcs., after leaving the

Mr. H. H. Lusty

Mr. E. E. Walker

Aston Technical School, joined the Electric & Ordnance Accessories Co. in 1907 and remained with that company until 1920. He served with the Royal Engineers during the 1914-18 war. In 1920 Mr. Walker joined the motor sales department of Metropolitan-Vickers, later transferring to the publicity department. He was acting manager of the department from 1941 to 1945 and then assistant manager until 1952 when he was appointed manager.

Mr. Eric Southwell, an engineering draughtsman at the Witton Works of the General Electric Co., Ltd., is to carry out an inquiry into the use of automation by a number of engineering firms in this country and in Western Europe for the European Productivity Agency. Mr. Southwell, who is a member of the National Executive Committee of the Association of Engineering and Shipbuilding Draughtsmen, has been given leave of absence by his company to enable him to undertake this work, which will occupy about two months.

The South Wales Branch of the **Electrical Trades' Commercial Travellers' Association** recently held smoking concerts at Cardiff and Skewen, Glam., which were attended by approximately 100 persons. A collection was made at both these functions, the proceeds being given to charity.

The annual ball of the Northern Counties Area of the **Electrical Industries Benevolent Association** was held on 4th December at the Old Assembly Rooms, Newcastle-on-Tyne. Over 300 guests were received by Mr. F. C. Winfield, M.Eng., M.I.E.E., Fellow Amer.I.E.E. (chairman), and Mrs. R. H. Davison, wife of the chairman-elect, who were supported by Mr. H. Riley (president, E.I.B.A.) and Mrs. Riley.

The third annual dinner of the **Ediswan (London and D/O) Long Service Association** was held on 30th November when sixty-eight members and honorary members gathered at the Horse Shoe Hotel, Tottenham Court Road, London. Mr. D. F. Botwright (publicity division) was in the chair and General Sir William D. Morgan (chairman, Siemens-Ediswan Group) was the guest of honour. Long service awards were presented to seven members of the staff. The toast to the company was proposed by Mr. K. S. Estlin and Mr. J. W. Ridgeway, a director of Edison Swan, replied. General Sir William Morgan also spoke.

The Minister of Fuel and Power has reappointed **Major C. L. Baldwin,** M.C., J.P., of Sinnington, York, and **Mr. John Bowman,** O.B.E., J.P., of Gateshead, as part-time members of the North Eastern Electricity Board.

Mr. A. F. Plummer, M.C., Associate I.E.E., has been elected deputy chairman of the National Inspection Board, to fill the vacancy caused by the election of Mr. C. R. King as the Board's chairman.

Mr. A. F. Plummer

Mr. Plummer is managing director of the Shoolbred Electrical Co., Ltd., Luton; he has been a member of the Board since its inception. He was president of the Electrical Contractors' Association in 1954-55, and is a member of the I.E.E. Wiring Rules Committee.

On 6th December the **J. & P. Staff Association** held a well-attended dinner at the Connaught Rooms, London. Mr. W. Glass, managing director, who proposed the toast of the Association, expressed regret that indisposition had prevented the attendance of Mr. G. Leslie Wates, who is this year celebrating his silver jubilee as chairman of the company. Mr. F. J. Aldridge, chairman of the Association, responded to the toast and concluded by reading telegrams of good wishes from Mr. Wates and Mr. Stanley Passmore, director. Telegrams were also received from the J. & P. branches at Melbourne, Sydney, Karachi, Germiston, S. Africa, and Bombay. The dinner was followed by a dance and cabaret.

Mr. E. J. Jones, secretarial officer of the Northmet Sub-Area, Eastern Electricity Board, is retiring on 31st January after over forty-five years' service in the electricity supply industry.

Mr. E. J. Jones

Mr. Jones joined the Metropolitan Electric Tramways in 1911, this company being associated with the North Metropolitan Electric Power Supply Co. During the 1914-18 war he served with the Queen's Westminster Rifles and at the end of hostilities returned to the Northmet Co. and was a secretarial assistant from 1920 until vesting date when he became secretarial officer of the Northmet Sub-Area.

After his retirement, Mr. and Mrs. Jones intend to take a holiday in Australia, returning to this country at the beginning of 1958.

The British Transport Commission have appointed a panel of consulting engineers to advise their chief engineers on technical problems associated with a.c. electrification. The members of the panel are **Mr. Julian S. Tritton,** M.I.C.E., M.I.Mech.E., **Mr. E. L. E. Wheatcroft,** M.I.Mech.E., M.I.E.E., and **Mr. Geoffrey F. Kennedy,** M.A., M.I.Mech.E., M.I.E.E.

Mr. E. J. Dowson, of the Electrical Development Association, celebrated his eightieth birthday on 28th November, and to mark the occasion his E.D.A. colleagues entertained him to dinner at the Waldorf Hotel, London, on 30th November. Formerly the Mayor of Doncaster, Yorks. (in 1925-26), and an alderman of Surbiton, Surrey (from 1940 to 1949), Mr. Dowson has been on the staff of the Electrical Development Association for the past twenty-eight years. He was chairman of the Doncaster Electricity Committee from 1921 to 1928. Before nationalisation he was E.D.A. area officer for the South Western and South Wales areas. He continues to represent the Association in these districts, particularly on matters regarding agrieultural shows.

At the dinner party held in his

Mrs. E. Haycroft, hon. secretary, Northern Counties Area, E.I.B.A., presenting a bouquet to Mrs. R. H. Davison at the Area ball. Others in the photograph are Mr. F. C. Winfield, Mr. H. Riley, Mrs. Riley, Mr. R. H. Davison and Mr. A. Parkin, hon. organiser of the ball

honour, birthday messages from a great many of his friends were received. Mr. V. W. Dale, director and secretary of E.D.A., proposed the health of Mr. Dowson at the dinner.

The Birmingham Aluminium Casting (1903) Co., Ltd., announces that **Mr. R. V. Dowle,** A.I.M., has been appointed general works superintendent.

On 31st December **Mr. J. H. R. Homfray** is relinquishing his position as sales director of Electrolux, Ltd., but remains on the board. Mr. Homfray joined Electrolux in 1926 following a distinguished naval career, and after experience as an area and district manager, became the refrigerator sales manager in 1928, a position he held until the outbreak of the war in 1939. Returning to the Navy and to the First Sea Lord's staff in the Operations Division he received the O.B.E. in 1942, later taking command of H.M.S. *Valkyrie,* a radar training establishment in the Isle of Man. Rejoining Electrolux in 1945 he was promoted to general sales manager in 1946, and became sales director in 1952. At a dinner given in his honour at the Café Royal on 7th December, Mr. Homfray was presented with an inscribed gold wrist watch, cigarette case, a pair of binoculars and a salmon fishing rod. He is succeeded in the Electrolux organisation as general sales manager by **Mr. J. Redman,** who joined the company in 1947. Mr. Redman has been assisting Mr. Homfray since 1953; previously he was manager of the western district of the company. He served in the Army between 1939 and 1946 and, on demobilisation, was a major in a machine-gun company of the Middlesex Regiment.

Mr. J. H. R. Homfray

Mr. J. Redman

There was a record gathering of 400 at the annual ladies' night of the **Association of Supervising Electrical Engineers** held on Saturday last at the Park Lane Hotel, London, members and their ladies coming from all parts of the country. Mr. H. E. J. Butler, national chairman of the Association, accompanied by Mrs. Butler, presided, and Sir Harold Bishop (president) and Lady Bishop were also present.

In proposing the only toast of the evening—to the ladies—Mr. Butler said that the function was the highlight of the Association's social programme. In welcoming the ladies he did not propose to dwell upon the technical work of the Association, which was of little interest to them. There were present, however, many members of the Electrical Association for Women, and he thanked those members of that Association who had assisted in judging in the domestic electrical appliance competition at the A.S.E.E. Exhibition. He referred to the success of this year's A.S.E.E. Conference and mentioned that next year it would be held at Blackpool in May.

Lady Bishop replying to the toast to the ladies at the A.S.E.E. Ladies' Night

Lady Bishop, in a charming response, expressed the ladies' appreciation for a most enjoyable evening. Following the speeches there was dancing and an excellent show by Eric Ross's " Dazzle " Cabaret.

At the monthly luncheon of the **Electrical Industries Club** at the Connaught Rooms, London, on Tuesday this week, with Mr. Leslie Gamage, M.C., the president, in the chair, the attendance was above the normal monthly average, no doubt because of the usual festive character of the December function. Mr. Morley Parry addressed the assembly after lunch.

The Institute of Metals has awarded the Rosenhain Medal for 1957 to **Dr. H. K. Hardy,** A.R.S.M., A.I.M., research manager, United Kingdom Atomic Energy Authority, Industrial Group, in recognition of his outstanding contributions to knowledge in the field of physical metallurgy.

Mr. H. E. Dixon, chief metallurgist of the British Welding Research Association, has accepted a senior appointment with Richardsons, Westgarth Atomic, Ltd. He has been succeeded as chief metallurgist of the Association by **Mr. P. T. Houldcroft,** who has been his deputy.

Mr. W. D. Kennedy, B.Sc.Tech., has resigned his position as assistant chief commercial officer of the Eastern Electricity Board in charge of economics and tariffs, to take a senior appointment in Vancouver, B.C., with Crippen Wright Engineering, Ltd. Mr. Kennedy was educated at Manchester University and started his electrical career with the Edmundson group of companies at Salisbury as a junior engineer. Later he was transferred to the General Manager's Department in London where he remained until 1941 when he joined the Royal Navy. After serving in the Far East, he was released from the Service in 1945 with the rank of lt.-commander. He rejoined Edmundsons and was appointed to the Eastern Electricity Board's staff on nationalisation of the industry.

Mr. W. D. Kennedy

OBITUARY

Mr. H. C. Hastings.—The death occurred on 7th December of Mr. Hammond Charles Hastings who, until he retired in 1947 after forty-nine years' service with the British Thomson-Houston Co., Ltd., was chief of the company's Control Gear Design-Engineering Department. After his early technical training at the Finsbury Technical College, London, Mr. Hastings joined the British Thomson-Houston Co., and was in charge of the meter section of the Test Department when the Rugby Works was built. He was one of the pioneer staff at Rugby, being initially in the Switchboard Engineering Department and subsequently in the Control Gear Engineering Department on its formation in 1903. He was placed in charge in 1908 and was responsible for the development of electric traction and industrial control gear for a period of thirty-nine years. He designed the earliest contactor equipments for the multiple-unit control of electric trains, and among his achievements in the industrial field was the design of contactor equipment for some of the earliest rolling mill plant and for auxiliary drives for steel mills, such as live rolls and screw-downs.

The late Mr. H. C. Hastings

Mr. Arthur Joseph Young, who died in a nursing home at Loughborough on 5th December, founded the electrical engineering business of Electroway

Heaters, Ltd., Loughborough, twenty-four years ago. Since April last year when he acquired the electric heating appliance manufacturing business of the Arora Company both businesses have been carried on in Rosebery Street, Loughborough.

Mr. W. S. Naylor, who was chairman of the Chloride Electrical Storage Co., Ltd., from 1929 until 1946, died at his home at Lytham St. Annes last week, at the age of eighty-two. Mr. Naylor was educated at King Edward's Grammar School, Birmingham, and served his apprenticeship with Veale & Co., electrical engineers, St. Austell. After taking a technical course at Finsbury Technical College and gaining practical experience he was appointed assistant manager to the Chloride Co. in 1902. Four years later he became general manager, and in 1921 joined the board. In 1929 he was appointed chairman and joint managing director. Although he retired from executive duties in 1933, Mr. Naylor remained chairman until 1946, when he relinquished the position to Mr. A. W. Browne, O.B.E., M.I.E.E. He continued to be a director until his death.

The late Mr. W. S. Naylor

Throughout his career Mr. Naylor showed a keen interest in the well-being of those who worked under his direction. He was responsible thirty-nine years ago for the establishment of the first works committee at the Exide Works and was concerned with the inauguration of many other workers' benefits, including the sick funds, pension scheme, long service grant and recreation clubs.

Dr. J. H. Partridge.—The death has occurred, at the age of fifty-three, of Mr. J. H. Partridge, Ph.D., D.Sc., a senior member of the staff of the research laboratories of the General Electric Co., Ltd., where he was head of the Glass, Refractories and Ceramics Department. An acknowledged authority throughout the world on refractory materials and glass-to-metal sealing techniques, Dr. Partridge was the author of two books and numerous papers on these and related subjects. He was educated at King Edward's Grammar School, Birmingham, and in 1921 entered the School of Metallurgy at Birmingham University. During the period 1925 to 1926 he gained a grant from the Department of Industrial Research and a Carnegie Scholarship from the Iron and Steel Institute. In 1947 he was awarded the degree of D.Sc. for his contribution to scientific and technological knowledge.

The late Dr. J. H. Partridge

A member of the Council of the Society of Glass Technology since 1934, Dr. Partridge was hon. secretary of the Society from 1946 to 1949. He was elected a Fellow in 1937 and in 1938 was awarded the Society's prize for the best series of papers describing original research published in its journal. In 1956 he was elected president of the Society. He was also a Founder Fellow of the Institute of Ceramics.

Mr. F. W. Phillips.—The death is reported of Mr. Frederick William Phillips, C.M.G., who was Director of Telecommunications, General Post Office, from 1935 to 1940. He was a member of the Television Committee which reported in 1935 and he then became a member of the Television Advisory Committee.

Mr. A. Smith.—The death occurred on 29th November, at the age of seventy-six, of Mr. Arthur Smith, who was chief electrical engineer to Joseph Rank, Ltd., flour millers, being responsible for 30 mills in the organisation. Mr. Smith was educated at Hull Technical College and before joining Ranks he served with the Emden Valley (Sheffield) Waterworks (chief electrical engineer), Hull Corporation and the Olympia Mills, Selby, where he worked with a German engineer-inventor on new developments in milling machinery. While with Joseph Rank his work involved the reinstatement of the Clarence Mills at Hull which were destroyed in the air raids on the city. Other new and rebuilt mills the electrification of which he was responsible for were the Solent Mills, Southampton; Premier Mills, London; Baltic Mills, Gateshead; and Caledonian Mills, Leith.

The late Mr. A. Smith

Mr. F. L. Best.—The death occurred on 6th December, at the age of sixty-three, of Mr. Frederic Lafargue Best, M.I.E.E., managing director of Best Products, Ltd. Mr. Best was educated at Brixton Secondary School and the Northampton Engineering College, London, and received his practical training with the Langdon-Davies Motor Co., and Provincial Cinematograph Theatres. He served during the 1914-18 war in the Royal Engineers. In 1924 he joined the Cambridge Instrument Co., Ltd., as chief test engineer, and in 1932 became works manager of the Electroflo Meters Co., Ltd. In the following year he set up as a consultant, and then founded Best Products, Ltd., marketing a number of his own inventions. He was a member of E.D.A. and B.S.I. Committees.

Mr. J. E. Hainsworth.—The death occurred on 28th November of Mr. J. E. Hainsworth, who had been chief engineer, London Region, with N. G. Bailey & Co., Ltd., since July this year. Before that, Mr. Hainsworth had been a director of T. Clarke & Co., Ltd., for many years.

Colour in the Home

A fact-finding committee set up by the B.E.A.M.A. Domestic Electrical Appliance Section to look into the problems of standardising colours used for domestic electrical appliances has now presented its report. The Committee, whose report has been adopted by the Section, finds that standardisation of the colours of domestic electrical appliances is not practicable as for technical reasons it is virtually impossible to guarantee that any given colour can be reproduced exactly. The major demand still appears to be for white and cream. To create any standards for industry for the colours (or shades) to be used for domestic electrical appliances would raise far more difficult problems than their adoption sought to eliminate. For these reasons the Section does not intend to take any further action.

Swiss Plant for Capetown

We are officially informed that the Capetown City Council has awarded the Oerlikon Co. of Zurich, a contract for two 30 MW turbo-alternators. The price quoted was £393,165 as against the quotation of the British firm (C. A. Parsons & Co., Ltd.) of £511,800. Parsons equipment is already installed in the Table Bay power station.

Voltage Tables

The 1956-57 edition of "Electricity Undertakings of the World" (the "Red Book") is now available from Benn Bros., Ltd., 154, Fleet Street, London, E.C.4, price 30s post free. In this, the sixty-sixth of the series, voltage details are given for 117 new localities in 18 different countries not previously included. Information about the Central Electricity Authority and Area Boards, the Scottish Boards, electricity authorities in Northern Ireland, and elsewhere, follows the same design as in the last edition, and has, together with that concerning the British Commonwealth and foreign undertakings, been thoroughly checked and revised. The number of pages has been increased to 636.

The New Zealand Market

British Electrical Exporters' Predominance

A REPORT by Mr. D. A. Bryan (United Kingdom Senior Trade Commissioner in New Zealand) on the economic and commercial conditions in New Zealand (dated February, 1956),* is much more comprehensive than the last one issued in 1949. It deals in some detail with the present and future of the electricity supply industry and with the expanding market for electrical machinery, equipment and appliances.

New Zealand is one of the United Kingdom's most important markets, and the bulk of the electrical equipment imported is supplied by United Kingdom manufacturers. The buoyant and expanding economy of the country, the rapid growth of the population and the high standard of living generate a demand which is very large in relation to the population, and for the United Kingdom manufacturer and exporter the large programme of development and the corresponding expansion of the New Zealand market offer great opportunities.

Figures given in the report show that of the total of £11·1 million of electrical machinery, goods and apparatus imported in the period January-September, 1955, no less than £9·1 million came from the United Kingdom, in addition to which there was a considerable demand for railway and tramway equipment (much of the railway equipment is either electric or diesel-electric). The United Kingdom supplied £1,394,000 of the total of £1,961,000 of this class of equipment imported in 1954.

Demand for F.H.P. Motors

Dealing with the various classes of electrical goods, the report states that approximately two-thirds of the 120,000 electric motors imported in 1954 were of fractional horse power for incorporation in refrigerators, electric saws, pumps, etc., and on farms, and about 140,000 electric motors of all types are so employed. The largest users of motors over 1 h.p. are the paper mills at Kawerau and Kinleith, where several thousand motors up to 300 h.p. are in operation. There is no local manufacture of motors, but some winding is done by one or two firms. The United Kingdom is by far the largest exporter, supplying motors valued at £1,070,000 of the total of £1,256,000 imported in 1954.

A number of schemes for the expansion of the power supplies in New Zealand are either under construction, approved or planned, and at the date of the report (February last) included plant with a total capacity of nearly 900,000 kW. United Kingdom manufacturers have in the past met 80 per cent of the demands in this field, but there is keen competition from a number of other countries. The United Kingdom's share of the total of £2,889,000 imported in 1954 was £2,409,000.

Filament electric lamps are made in New Zealand by two concerns, one wholly and one partly controlled by United Kingdom manufacturers, who also produce daylight blue, street lighting and rough service types. Imports are by licence, but large quantities are imported. Local production of fluorescent lighting equipment in 1953-54 amounted to £334,000. There are nine concerns producing this equipment and they are protected by a total prohibition of imports of complete fluorescent lamps (except those for street lighting). Imports of electric lamps and fittings in 1954 were valued at £858,000, of which the United Kingdom supplied a total of £591,000. The assembly of radio receiving sets is a well-established industry and is protected by a total prohibition of imports, which now consist mainly of radio components for local assembly and of transmitting equipment.

There is no significant production of telephone equipment in New Zealand and the United Kingdom supplies virtually the whole of the country's requirements. Imports in 1954 were valued at £1,216,000, of which equipment totalling £1,123,000 came from the United Kingdom.

Imports of domestic electrical appliances and parts in 1954 were valued at £1,605,000, of which the United Kingdom's share was £1,373,000. There is considerable local manufacture of vacuum cleaners, washing machines, cookers, and the smaller appliances such as toasters, kettles and irons. Overseas competition is marked in certain lines particularly from Australia whose exports to New Zealand have risen sharply.

There are four manufacturers of wires and cables in New Zealand, the major unit in the industry being owned by member companies of the United Kingdom Cable Makers' Association. Imports fell sharply in 1954 owing mainly to a reduction in the value of licences issued. The United Kingdom supplied a value of £1,496,000 of the total of £1,645,000 imported. Greater imports were permitted in 1955 and for the first six months imports were valued at £1,610,000.

Railway Equipment

In the field of transport equipment, the report states that steam locomotives and some diesel shunting locomotives are made in New Zealand, but the main demand, for electric and diesel-electric equipment, is increasing. Large orders have been placed with United Kingdom and American concerns for diesel-electric main line locomotives, but it will be necessary for British manufacturers to offer keen prices and good deliveries if they are to avoid a further reduction in their percentage of the market. There are tramways operating now in only three cities—Auckland, Wellington and Dunedin—and the policy is in time to replace the trams by trolley-buses and motor buses. Some trolley-bus bodies have been constructed in the city corporations' own workshops, but most trolley-buses are imported. The value of imports of railway and tramway plant in 1954 was £1,961,000, of which equipment valued at £1,394,000 came from the United Kingdom.

The report contains a great deal of interesting information on the development of the electricity supply industry. The total generating capacity in the year ended 31st March, 1955, was 940,207 kW, of which 645,000 kW was in the North Island and all was hydro-electric except about 53,400 kW of steam plant and 14,400 kW of diesel plant. After mentioning some of the more important projects under construction, the report refers to proposals for meeting the demand in the North Island where the potential hydro-electric power is not sufficient to meet foreseeable requirements. These proposals include the laying of submarine cables between the South and North Islands to provide power from the South where the potential hydro-electric power is in excess of anticipated requirements.

* H.M. Stationery Office, price 10s net.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE phenomenon of a.c. corona has been fairly comprehensively investigated from the viewpoint of active power losses associated with it, but far less thoroughly with respect to the charging effects causing increased VAr consumption or, expressed differently, an increased capacitive reactance. The latter cannot fail to influence surge phenomena, particularly on idling lines. The usual model of a cylindrical capacitor of which the conductor under corona forms the inner electrode, enables the physical essentials of the process, role of space charges, etc., to be well enough understood to evolve a working, if approximate, theory of the process. If this is applied to experimental data (oscillograms) obtained on lines with single and grouped conductors, it becomes possible to carry out a harmonic analysis of what authors call the " compensated current," i.e. the actual corona current minus the current of its geometrical capacitance.

Although this compensated current has no physical entity, it proves to be a very useful theoretical concept in the investigation of the actual physical phenomena. This analysis was actually applied to line models with single and grouped conductors of 1·2 and 30·2 mm diameter. Good agreement was found between the experimental curves for both conductor sizes and types (single and grouped). Also, the relations between relative surge voltages (referred to critical disruptive voltage) and amplitudes of the corresponding harmonics are approximately the same for single and grouped conductors. These relations may be used for approximate calculations of surge voltages due to corona and in the design of models for corona tests.—" The Reactive Effect of A.C. Corona," V. I. Levitov and V. I. Popkov, *Elektrichestvo,* No. 7, pp. 24-29, 1956, in Russian.

Electrical Accidents

The prevention of electrical accidents is developing into a science of its own, although the infinite variety of situations which may lead to accidents and, even more, the fact that in most cases physical, physiological and psychological circumstances must combine to produce an actual accident, render it very difficult to deduce, e.g. from comprehensive, yet mostly only superficially classified, statistical data, more than very general principles of protection. Moreover, the objective dangers, i.e. those of incorrectly designed or actually faulty installations and equipment, are, according to statistics, responsible for 80 per cent of all accidents, only 20 per cent being due to carelessness, fortuitous and unpredictable coincidences of adverse circumstances or " acts of God."

This is encouraging, since the inherent dangers of installations can be established and in most cases removed, while human behaviour depends itself on a multitude of factors, even time of day and season, concentration on some kind of work or other pursuits and, obviously, knowledge and appreciation of potential dangers. Considerable progress has been made in distinguishing between the inherent dangers of h.v. and l.v., a.c. and d.c., various frequency ranges, etc., and the typical physiological effects of all these danger sources are not only well known, but methods of first aid and after-treatment are well developed. The author presents a well-considered systematic survey stressing the physiological and psychological causes, and effects, of accidents from which it is particularly interesting to find that accidents to children are predominantly due to ignorance of dangers, those to people of average age 22 to carelessness, at average age 28 to under-rating dangers, and at average age 45 to lack of concentration.—" Classification of the Electrical Accident," G. Meyer, *Dtsch. Elektrotech.,* Vol. 10, No. 9, pp. 330-335, September, 1956, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

Servo-System Stability

A consideration of the simplest servo-system, i.e. positional control system with governor, shows that the known criteria of stability are not sufficient for solving all the problems occurring in the design of servo-systems. The representation and demonstration of the fundamental and typical problems is greatly simplified by the use of Laplace transforms and operational calculus, applied to simple block diagrams representing even complicated servo-systems. In this way it is possible to show how and why the " practical " stability criteria of a servo-system are more restricted, or rigorous, than those of the mathematical theory.

These general considerations are applied to the Routh and Hurwitz criteria and the latter form a fitting transition to the exposition of the principles of the synthesis of analogue schemes for servo-systems of various types by the aid of which the most important design problems of regulation and servo-systems can be solved. It is possible to vary the character of the response of practically every element of the system and to watch and record the effect of this on the behaviour of the whole system. Then the re-translation of the experimental results into a mathematical form is possible (and relatively simple), and so the original design problem can be solved.—" Analytical Calculation and Analogue-Computing of Servo-Systems," D. Zanobetti, *Elettrotecnica,* Vol. 43, No. 8 bis, pp. 426-440, 30th August, 1956, in Italian.

Resonance in Induction Motor Circuits

Induction motor drives for periodically varying loads are usually designed on the basis of static mechanical characteristics of the motor without considering the transient electromagnetic phenomena. This takes no account of a possible danger introduced by transient processes, viz. resonance phenomena. On the other hand, even so prominent an author as Rüdenberg in his book on " Transient Processes " omits to investigate the physical conditions leading to resonance in induction motor circuits really thoroughly, particularly failing to notice or mention the great effect of the resistance in the stator circuit on the production of resonance conditions. Yet this danger is well known to the designers of motors for textile machinery and they are, as a rule, capable of preventing resonance conditions arising in their drives by more or less empirical methods. Obviously, a general and sufficiently rigorous method of calculating the natural frequency of an induction motor is required and the author shows that this can be done in the same way as for a

synchronous machine, since the elastic linkages set up during transient periods confer on the induction machine the character of a synchronous machine. The dangers of serious resonance phenomena under pulsating loads, viz. heavy stator current, mechanical vibrations and noisy running, are aggravated by high resistance in the stator circuit and small inertia moment and rated slip of the motor.—" Resonance in Induction Motor Drives under a Pulsating Load," V. S. Mogilnikov, *Elektrichestvo,* No. 8, pp. 22-26, 1956, in Russian.

Induction Motor Tests

The short-circuit test on induction motors is carried out with a reduced voltage and at currents equal to, or up to 20 per cent higher than, the rated current. For convenience the short-circuit current for the rated voltage is then calculated by assuming it to be proportional to the voltage. This assumption does not correspond to the physical facts, as a short-circuit test taken up to the rated voltage clearly demonstrates. Actually, the deviation of the current-voltage curve from a straight line commences from a certain point some distance below the rated voltage. The tests also show that the starting torque increases with more than the second power of the voltage applied. The author is able to show that, if reasonable and actually realistic assumptions are made on the phase relations of secondary short-circuit current and e.m.f., very useful approximate formulæ for the " true " short-circuit current and starting torque at the rated voltage may be derived, in which the errors due to the temperature rise of the machine may also be eliminated.—" Some Considerations on Short-Circuit Tests of Induction Motors," A. M. Pagano, *Elettrotecnica,* Vol. 43, No. 8 bis, pp. 447-453, 30th August, 1956, in Italian.

ENGINEERING TRAINING ABROAD

A REPORT appeared in the *Electrical Review* of 30th November of Dr. B. V. Bowden's Sir Alfred Herbert paper dealing with the education and training of engineers in other countries. Two papers on this subject were presented on 30th November before the Institution of Mechanical Engineers. The first, by Dr. H. S. Arms (manager, Atomic Power Projects of the English Electric Co., Ltd., Babcock & Wilcox, Ltd., and Taylor Woodrow, Ltd.), gave particulars of the American system and the second, by Prof. S. J. Davies (Dean of the Royal Military College of Science, Shrivenham), dealt with conditions in European countries.

Dr. Arms said that a far higher proportion of engineers in the U.S.A. held degrees of university status (30,000 in 1954 from 210 institutions) than in Great Britain, but the number of graduates there appeared to be decreasing. A relatively small number came from technical colleges with academic standards of the type required for the British Higher National Certificate. Professional status was conferred not by engineering institutions but by State boards, normally after formal examination. Typical entrance requirements of colleges and technological institutions included secondary school credits for English, algebra, geometry, trigonometry, chemistry and physics, the first two being the most important. Vocational subjects earned only half the usual credits. There were also elective subjects, of which science, mathematics, history and foreign languages were regarded as desirable.

University engineering courses usually lasted four years. Sandwich courses were increasing in number. The tendency was to deepen and broaden their basic science content. Previous systems of education in electric power engineering were considered to have been largely a recapitulation and refinement of past techniques. The Massachusetts Institute of Technology, for instance, had abandoned all educational plans based on vocational options and established a core curriculum for all electrical major subjects. This had involved disposing of much conventional equipment in the machine laboratory and focusing students' attention on the objectives of investigation rather than on instruments and techniques. The emphasis was on the fundamental physical sciences which governed engineering and on materials and methods of handling them.

By far the majority of professionally qualified engineers in the U.S.A. had never undergone a period of training, such as is normally required by British engineering institutions, as a qualification for corporate membership. The separation between technological and technical training was sharper than in Great Britain. More training time was spent on learning how a company was organised than on how to carry out particular processes. No more than 15 per cent of engineering students received scholarship grants, which were usually between $100 and $200 a year.

Professor Davies surveyed the systems of engineering education in eight European countries. These countries were Western Germany and Berlin, Netherlands, Sweden, Denmark, Norway, Austria, Switzerland and France. Although Great Britain was more highly industrialised than any, it shared with Austria and Belgium the lowest place in respect of the relative numbers of engineers of degree level. Nevertheless, there were vacancies in British universities, largely because of the small numbers studying science in the sixth forms of schools. The position here in respect of higher degrees was, however, relatively better; but the lack of qualified engineers to fill posts abroad was likely to lead to loss of trade.

Particulars of degrees and diplomas in respect of each country and of the whole were shown in eleven tables. Index figures were obtained by dividing the total number of graduates in engineering (classified according to its type) by the population in millions. In comparisons between these European countries and Great Britain, those who qualified for Higher National Certificates were omitted, but in all countries at least equivalent facilities were said to be offered for study.

In Continental schools courses lasted for at least four years compared with three years in this country. The latter seemed the right length, having regard to the greater emphasis placed here on practical training, but an early and considerable strengthening of the courses at post-graduate level was to be hoped for. Increased provision for technological education both in the universities and in colleges of technology in Great Britain were greatly to be welcomed, but it could not be properly utilised until a supply of suitable students was ensured by an expansion at top level of the science sides in the schools.

Railway Careers

THE British Transport Commission has issued a brochure, " Careers with a Future," in which it outlines its training courses in mechanical and electrical engineering on British Railways through graduateships and apprenticeships. The brochure is primarily designed for the use of appointments officers, career masters and others whose concern it is to know what training for engineers is to be had and what their prospects are in the railway service. The brochure is well produced and illustrated.

Calibrating Voltage Transformers

Australian Methods of Error Measurement

EQUIPMENT and two absolute methods employed at the National Standards Laboratory, Australia, for the precise measurement of errors of voltage transformers were described to the Measurement and Control Section of the Institution of Electrical Engineers on 4th December by Messrs. W. K. Clothier and L. Medina of the Commonwealth Scientific and Industrial Research Organisation.

In one of the methods ratio balance is obtained by means of a small auxiliary variable-ratio voltage transformer and phase balance by current injection into one of the detector bridge junctions. In the second method, ratio balance is provided by a variable three-terminal air capacitor in the low-voltage arm of the divider and phase balance by voltage injection in series with that arm; a feedback amplifier gives a low-impedance injection circuit. In both cases the accuracy of measurement is given as approximately two parts in 10^5 in ratio and 0·05′ in phase angle.

Discussion

The discussion was opened by Mr. D. Edmundson (B.T.H.) who said that the circuit described, at least the first one, was singularly free from objections. It was a good practical circuit, besides being accurate. The authors had made a bridge that could be direct reading in error and that was an advantage, calculations not being necessary. Furthermore, the potential of the screen or guard did not need to be separately adjusted. He then described a circuit used by his company and said that although it had the virtue of automatic fixing of the guard potential, and was a good and accurate circuit, still in daily use, it did not give a direct reading and a low-voltage mica capacitor had to be used.

Mr. L. W. Pettit (Elliott Bros.) on behalf of Mr. Hawkes who was unable to be present, said it would be advisable to call the authors' method of calibration a direct method as opposed to the difference methods using a standard transformer for reference. In both cases where the out-of-balance signal had to be resolved into in-phase and quadrature components, high accuracy was only approached where the error signal was relatively small. He asked whether the authors' accuracy of 2 parts in 10^5 for both ratio and phase angle for their method, which was both frequency and waveshape conscious, was realistic in view of the h.t. supply required. He suggested that the national laboratories might well develop a direct method of measurement which would give errors of voltage transformers under practical conditions of, say, about one or two per cent harmonic distortion in the supply voltage. The method would be complex and could only be undertaken by a national concern, but it could produce valuable information.

Mr. A. Felton (N.P.L.) said that one of the most elegant features was the build-up check on the capacitors. It took only a few minutes and no readings or measurements were required. Another feature he liked was the substitution check applied at the end. The authors measured the errors on one of their own transformers kept for the purpose at the particular ratio they had been interested in and observed that the errors were the same as last time.

Mr. S. W. Redfearn (Metropolitan-Vickers) observed that the paper was timely, but for those anxious to do practical work on the subject it seemed to raise more questions than it answered. He had no criticism of the paper, which was complete in itself. But it did give one furiously to think what services central laboratories or research departments could give to assist the people who were so hard-pressed on testing. They had very good laboratories and most of the time they did the job all right, but they worked under considerable pressure and he wondered whether, if this elegant circuit were adapted to full works testing, there might not be some unsuspected ways in which someone could go wrong with it.

Mr. J. K. Webb (Standard Telecommunication Laboratories) said he had once dabbled in high voltages and was still interested, though as a layman now, in their measurement. In his time, they had electrostatic voltmeters but one never liked to rely on a single method and what seemed now to be dignified by the name of Yoganandam's circuit had been used. A tertiary winding was used on the transformer, which was an excellent device. The Yoganandam circuit worked well, though he was conscious that there were errors due to the mica capacitors and the error ratio of the transformer. It certainly gave confidence in the other method of measurement. He was glad to see that the errors had now been eliminated by the ingenuity of the authors.

Mr. G. W. Bowdler, who took part in the discussion as well as presenting the paper and replying briefly to the points raised, described the general method of testing voltage transformers by connecting the voltage divider, consisting of two impedances in series across the primary winding and another voltage divider across the secondary. If there was about 1 V across the arms, there was sufficient sensitivity, especially with electronic detectors. Half the battle consisted in finding out the relative values of the impedances.

Australian News

DETAILED statistics of the electric light and power works of Australia in the financial year to 30th June, 1955, have just been released by the *Commonwealth Statistician*. These show that at that date there were 351 such works employing 11,927 workers at an annual salary and wage bill of £11,457,000. The average salary and wage per employee (£293 in 1939) was £966.

Total generation of electricity has risen from 4,688 million kWh in 1939 to 15,172 million kWh in 1955. The preliminary figure for the financial year ended 30th June, 1956, is 16,788 million kWh. During the year 1954-55 plant additions and replacements cost £28,300,000.

The Victorian State Electricity Commission's latest £3½ million power loan closed under-subscribed by £1,722,850, the balance being taken up by the Commission's underwriters.

Sales of electrical goods and radio equipment in Western Australia have shown a steady increase in the past three December quarters. In 1953 these amounted to £2,100,000; in 1954 to £2,400,000; and in 1955 to £2,600,000. Sales for the year ended 30th June, 1955, totalled £7,400,000.

Australian Electrical Industries Pty., Ltd., is to complete its new Sydney factory by the end of this year, and will begin producing television receivers and components in the New Year.

Measuring Earth-Loop Resistance

I.E.E. Measurement and Control Section Paper

IN an integrating paper presented before the Measurement and Control Section of the Institution of Electrical Engineers on 6th December, Mr. G. F. Tagg (Evershed & Vignoles) described an instrument for measuring the resistance of an earth-loop, instead of its impedance by current injection as prescribed by I.E.E. Regulation No. 507 of the Electrical Equipment of Buildings (see Fig. 1). Instruments now available for carrying out the I.E.E. test all drew their current from the mains, but the accuracy of results in most cases was seriously impaired (perhaps by 100 per cent) by the existence already of a voltage drop in the neutral conductor that varied continuously and rapidly. When that happened the volt-ampere method or its modifications and to a lesser degree the bridge method were subject to errors. The new instrument drew its testing current from its own 30 W hand generator and was claimed to be free from these errors and other complications. It was also suggested that as the difference between impedance and resistance was usually so small the measurement of the latter was sufficient.

In the method described direct current was passed through the resistance under test and periodically reversed, ignoring any reactive inductance in the circuit (see Fig. 2). The instrument had a range of 0 to 50 ohms (semi-logarithmic scale) and gave testing currents of 300 milli-amps and of 2 to 3 A.

DISCUSSION

The discussion was opened by Mr. H. W. Swann, who thought there might be some danger of the purpose being lost sight of in the pursuit of extreme accuracy. If tests were to be of value their aim was to decide whether automatic protection would clear all earth faults.

He was at some loss to understand whether they were nearer to fixing a minimum current below which one should not go and whether if there was a constant of that kind it should be stated in watts, volts or amperes. Another question was whether phase displacement or neutral voltage was most important to accuracy, or whether both had an equal effect. There was a tendency to give more attention to impedance. Finally, there was some merit in Roscoe's test—putting an actual fault on a system and seeing if the fuse would blow.

Mr. J. Hall (Troughton & Young, Ltd.) said that it was alarming to an installation engineer to be told that his calculation of fault current might be considerably out. He did his best to comply with the I.E.E. Regulations but he had been faced with the business of resistance *versus* impedance for 6½ years now and it had caused difficulties all the way through. In the light of Dr. Tagg's paper perhaps the matter could now be clarified. Otherwise there would be difficulties with the National Inspection Council in the future. The best method of dealing with it would be by means of a team, and installation engineers would be only too pleased to co-operate in the field.

Mr. G. F. Shotter, who did the original experiments on oxide films, described the method used and the characteristic curve obtained. It was absolutely essential to have some idea of the state not only of the earth-continuity conductor but of other parts of the circuit with the low-high-low method of testing described in the paper.

Mr. T. C. Gilbert observed that unless laboratory tests were to be hopelessly inaccurate the insulation of the neutral must be impeccable. If there were earth faults on the neutral or any conductor connected to it the testing current would be shunted and the loop test might be vitiated. Consideration should be given to the advantages of using the phase for testing. He thought the discussion demonstrated that it was almost futile to try to find out what was good protection with direct current. It would

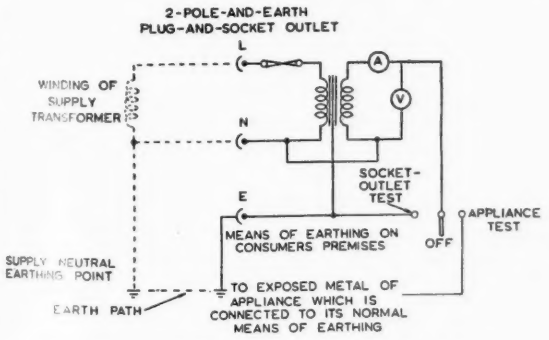


Fig. 1.—Current-injection system (I.E.E. Wiring Regulations)

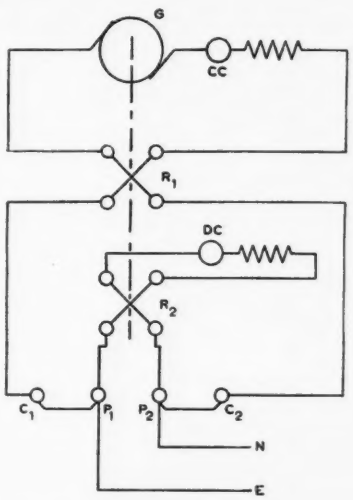


Fig. 2.—Circuit of reversed d.c. instrument. G—Hand-driven generator. CC—Control coil of moving-coil ohmmeter. $R_1 + R_2$—Reversing commutators mounted on generator spindle and running in synchronism. $C_1 + C_2$—Terminals of instrument connected to earth-loop, through which reversed d.c. passes. $P_1 + P_2$—Terminals of instrument to which is applied the voltage drop in earth-loop, producing a rectified current through the deflecting coil, DC, of the moving-coil ohmmeter. N—Neutral. E—Earth

be more rewarding to consider methods of installation and systems less liable to earth fault by a greater use of double insulation, for instance, and if necessary, backing it up with voltage operated protection.

Mr. C. E. Bedford (Ministry of Works) said that Dr. Tagg's instrument had the advantage of consistency. Much of the labour employed at the present time was semi-skilled and he would be glad if they were permitted by the Regulations to use such an instrument as it could be depended upon to give results which did not need too much translation.

Mr. S. F. Knight suggested that the proper way to test anything was under working conditions. It might be a good thing to test these circuits by putting in a fuse and blowing it. It was the most direct method and might prove the cheapest when one considered the relative value of the cartridge fuse and some of the expensive testing instruments. With regard to interference between different instruments, he said he foresaw the possibility of teams with testers being sent out to, say, a new housing estate. They might be working on houses in the same street, injecting 40 volts into the neutral, and one wondered what sort of interesting results might be obtained !

Mr. R. G. Parr (E.R.A.) said that recent work by the E.R.A. on impedance testing had been confined to two issues. Was it necessary to use the a.c. mains supply frequency as opposed to a d.c. testing set? And if it appeared that an a.c. test was necessary, was it possible to make this test in some form whereby the errors due to the neutral voltage were eliminated? He described the results which had been obtained and said that an instrument which worked satisfactorily had been made along the lines of these results.

Electrical Contracting Viewpoint

Mr. G. F. Bedford said that he spoke from the point of view of an electrical contractor and when he first read the paper he thought life was probably going to be much easier. Here was an instrument which gave results about twice as good as those given by the instrument they had been educated to use. Until the Wiring Regulations Committee could be persuaded to modify their regulations he feared the electrical contractor must still make every endeavour to keep to as low a value as possible the impedance or resistance of that part of the earth-loop circuit for which he was responsible.

Dr. G. L. d'Ombrain suggested that it was unfair to condemn a tester on the ground of Dr. Tagg's analysis. While it was correct, it was not the way the tester was supposed to be used according to the 13th Edition of the Regulations. The correct method was to average the current readings and divide them into the constant, which was the test voltage.

Mr. E. Roscoe said that the tester required must be suitable for use by a semi-skilled staff, light in weight so that it could be taken on public service vehicles in time of transport difficulties, easy to operate and not requiring a lot of calculations. It must tell whether a fuse would blow. The real aim was to find the earth-fault current. He then described the instrument devised to solve his problem as a testing engineer in the supply industry.

Mr. W. T. J. Atkins said that the author claimed that the reversed d.c. instrument, as he called it, read only the resistive component and ignored the reactance. It did nothing of the kind, and this claim should not be taken at its face value.

Mr. R. E. Jennings, speaking as a manufacturer, said that basically the latter should consider the safety of the equipment in use, its simplicity in operation, portability, cost and rating. With these considerations in mind his company had manufactured a piece of equipment and had decided that a reasonable value for the current was 10 amperes.

Mr. H. S. Petch said that cognisance must be taken of the fact that the neutral of a three-phase system tended to be a good collector of harmonics. It was equally true that the neutrals of many three-phase systems tended to collect a great deal of d.c. from " untransformed " television sets.

The author briefly replied.

Interactions of Physics and Biology

AT the anniversary meeting of the Royal Society on 30th November, the president, Sir Cyril Hinshelwood, delivered an address on some interactions of the physical and the biological sciences. At one time, he said, the two were almost completely separated, but to-day the lines of demarcation were gradually vanishing. Interpretation of nerve action in terms of ionic flow and analogies between the workings of the brain and electronic calculators provided instances that indicated the need for simultaneous study of widely different fields of science.

Among numerous examples of interplay between the two sciences was cited the making of the huge molecules of polymers almost to a predetermined specification of properties; this study (partly due to industrial stimulus) embraced some of the chief constituents of the living cell. Natural compounds of very high molecular weight, formed at low temperature and under the directing influence of existing cell structures, had normally a much more regular configuration than chains randomly formed in polymerisations initiated by free radicals at high temperatures. Initiating mechanisms might be ionic, but the repeated regularity was almost certainly due to new catalysts, such as those based on aluminium alkyls and titanium or vanadium chlorides.

Professional Opportunities

SPEAKING at a lunch of the Northern Ireland Branch of the Engineers' Guild on 28th November, Mr. Bryan Donkin (Kennedy & Donkin), the Guild president, referred to the estimate given in a recent Government report that 70 per cent more professional engineers would be required within the next ten years and 100 per cent by 1970. Engineers who recently visited Russia had reported on the inducements offered there to suitable candidates for training, who included almost as many women as men. The visitors had stated that in that country there was so much leeway to make up in industrial development that it probably would not compete seriously with this country in the export market for another five to ten years.

The Government report indicated the comparatively small proportions in which qualified scientists and engineers were employed in British industry. The highest was the Atomic Energy Authority with 10·9 per cent, then mineral oil refining with 2·5 per cent, after which came the electricity, chemical and aircraft industries with between 2 and 3 per cent and constructional engineering with only 1·5 per cent.

A survey of the directorates of 725 engineering companies had disclosed that in 1952 over two-thirds of the directors had no technological qualifications and that two-fifths of the companies had no technically qualified directors. The remedy was to raise the status of engineers (which was not only a question of remuneration) in the eyes of the community. Perhaps the most important of the many functions of the Guild was to act as a " public relations wing " for professional engineers as a whole.

INDUSTRIAL NEWS

Professional Engineers' Pensions

Details of a pensions scheme sponsored by the Engineers' Guild (78, Buckingham Gate, London, S.W.1) are given in a booklet issued by the Guild. The scheme, which has been arranged in conjunction with a well-known Life Office, is open to all members of the Institutions of Civil, Electrical and Mechanical Engineers but those who are members of the Guild will be allowed a special rebate.

Because of the changes made by this year's Finance Act the plan is in two sections. Scheme I is thought best to meet the requirements of most professional engineers; Scheme II, which is more applicable to the older self-employed engineer liable to super-tax, is to be inaugurated at a later date.

Under Scheme I an engineer can take out endowment assurances, deferred annuities or various temporary life assurances. The age range is 21 to 60; pensions can be taken at any age between 60 and 70 and the total contributions are limited so that the total pension which will be secured will not exceed £750 per annum if the member is under 35; £1,000 if under 40; and £1,500 if over 40. The booklet contains tables of annual premiums for various ages of entry.

A special trust company has been formed to ensure continuity of the scheme.

Transformers for T.V.A.

Two of the largest three-phase transformers ever built have been ordered by the Tennessee Valley Authority from the English Electric Co., Ltd., for the Authority's new power station at Gallatin, Tennessee. Their capacity is 345,000 kVA each and they are to transform the generator pressure of 22·5 kV up to the transmission voltage of 165 kV.

The value of the contract is over £300,000 and the transformers will be built in the English Electric works at Stafford.

E.E.B. Agricultural Courses

In keeping with its practice of providing training courses for members of its staff, the Eastern Electricity Board has just completed two courses for agricultural representatives employed by it and for members of the staff who have to deal with farmers in the course of their duties.

Employees from the six sub-areas of the Board attended the courses which were held at Russell House, Ipswich, where they were addressed by Mr. W. Newcome-Baker, who is a member of the Board, on "The Importance of Electricity to the Modern Farmer"; by Mr. P. Wakeford (C.E.A.) on "Electricity and the Dairy Farm"; by Mr. C. A. Cameron-Brown (C.E.A.) on "The World Picture of Farming Electrification"; and by Mr. P. Finn-Kelcey (E.R.A.), who spoke on "The Problems of Grain Crop Drying."

Nickel Price Raised

The United Kingdom price of nickel has been raised to £600 a ton by the International Nickel Co. of Canada; it had been £519 since November last year.

An agreement has been reached by the company with the Manitoba Hydro-Electric Board for the construction by the Board of a hydro-electric plant on the Nelson River to supply power to the company's new project in the area. The company will help to finance the power plant.

"Queen of Light" Competition

On Monday evening last the national "Queen of Light" beauty competition, promoted by the A.E.I. Lamp & Lighting Co., Ltd., which commenced in July in fifty places covering Scotland, Northern Ireland and Wales, as well as England, reached its final stage when eighteen girls, three from each of six regional semi-finals, took part in the final judging held at the Lyceum, London. The prize for the girl elected British "Queen of Light" was £100, and altogether there were £1,000 in cash prizes. A new feature this year was a contest at which the judges chose the best regional team.

There was a large gathering at the Lyceum to witness the judging. The new "Queen of Light" is Miss June Dawson (Liverpool), the youngest of the contestants. Miss Stephanie Howell (New Brighton) was placed second and Miss Brenda Warden (Edinburgh) third. The winning regional team was that from the Southern Region. The prizes were presented by Mr. A. H. Goude, manager of the head offices sales of the A.E.I. Lamp & Lighting Co., Ltd. During the evening there was dancing and a cabaret.

Disposal of Lead and Zinc Stocks

The Board of Trade is about to make arrangements for reducing its stocks of lead and zinc in accordance with the policy announced in February of running down the strategic holdings of industrial raw materials. The rate at which disposal will be made will not be decided until discussions with trade representatives have taken place. No sale will be made before the middle of January, 1957.

Trade Effluents Inquiry

Sir Frederick Armer, chairman of the Board of Control, and formerly deputy secretary, Ministry of Health, has been appointed chairman of a sub-committee set up by the Central Advisory Water Committee to inquire into the law dealing with trade effluents. Any person or body wishing to give evidence to the sub-committee should send a memorandum to Mr. H. R. Pollitzer, secretary, Trade Effluent Sub-Committee, at the Ministry of Housing and Local Government, Whitehall, S.W.1.

Electric Cookers on the Stage

When J. W. French & Co., Ltd., manufacturers of "Frenlite" flour, staged a cookery demonstration during a variety show held at the Birmingham Hippodrome twice daily from 26th November to 1st December all the cooking was done on Jackson "194" electric cookers installed in the theatre with the co-operation of the Midlands Electricity Board, the cooking demonstrations being given by Miss Marguerite Patten, the T.V. cookery expert. The audiences numbered some 24,000.

Flameproofed Timber

There is a growing demand for pressure flameproofed timber for use in buildings and engineering projects of many types. Recently we saw a film entitled "Cease Fire," which has been produced by Hickson's Timber Impregnation Co. (G.B.), Ltd. This demonstrates the use and performance of "Pyrolith" flame retardant timber preservative and the many uses of such impregnated timber in various industries. The film is 16 mm in sound/colour and its running time is 25 minutes.

Electrode Boilers for Quebec

Bastian & Allen, Ltd., have just completed the shipment of nine electrode steam boilers, with a capacity of 1,375 kW each, to the Quebec Hydro-Electric Commission for its Bersimis No. 2 Project. The order for these boilers was placed with the company through Modern Engineering Industries of Montreal in July last on the condition that they should be shipped by the last steamer to reach Montreal before the St. Lawrence froze. In order to carry out this difficult undertaking the services of the Board of Trade in London were secured and also the co-operation of the English Electric Co., Ltd., which supplied the circuit-breakers, and Worthington Simpson, Ltd., who supplied the boiler feed pumps.

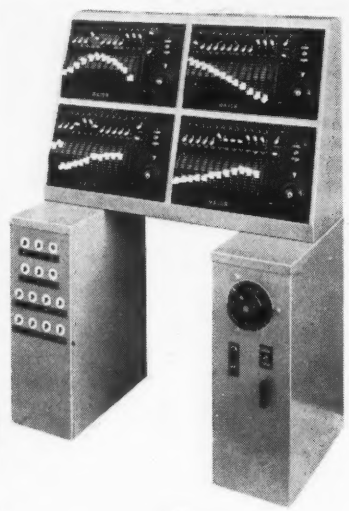
The boiler shells had to be constructed to the requirements of the Canadian authorities and this involved radiographing of the longitudinal and circumferential seams which was successfully done in time. This will be one of the largest electrode steam boiler installations in the world and will supply steam for the central heating, domestic hot water, cooking, dish

washing, etc., for a township of about 3,500 persons who are carrying out the No. 2 Project. The power to operate the boilers will be supplied by the Bersimis River Project No. 1 which is now in operation about 25 miles from Project No. 2. At the completion of Project No. 2, since people to operate the plant will live at the Labrieville townsite (Bersimis 1), it will be possible to remove practically all the boilers to another project.

Unusual Lighting Control Desk

The accompanying illustration is of a lighting control desk constructed by the Major Equipment Co., Ltd., in collaboration with Mr. C. A. L. Levick, A.R.I.B.A., for installation in the Town Hall, Nairobi. It is a 48-way choke-type dimmer equipment and has an arrangement of two-way and off switches which enables all circuits to be separately or group controlled, while further switching facilities are provided by the inclusion of both master and grand-master controls.

A light multi-core cable connects the control desk with the saturable chokes



Lighting dimmer control equipment for Nairobi Town Hall

(not illustrated) which, with metal rectifiers, relays and fuses are separately housed in racks fixed in any convenient position nearby or any distance away. This method of dimming provides effortless operation, is economical in electricity consumption and carries negligible maintenance charges.

Tanker Electrical Equipment

Laurence, Scott & Electromotors, Ltd., has supplied a duplicate of the equipment ordered for the tanker *Spyros Niarchos* for the *Evgenia Niarchos*. This includes about fifty electric motors for the drive of engine room and other auxiliaries.

The majority of the motors are of the "Trislot" squirrel-cage type, which takes a lower starting current for a given starting torque than a normal squirrel-cage motor, thus reducing the demand on the ship's alternators. The motors are of the marine drip-proof type, for vertical mounting in the case of most of the larger pump drives. The largest machines include motors for Drysdale circulating pumps, Brown Bros. steering gear and Weir extraction pumps, and a 150 kW auxiliary alternator (Davey Paxman engine).

B.T.H. Rationalisation

Increasing demand for electrical equipment of all kinds, both small and large, has led to considerable expansion of the manufacturing resources of the British Thomson-Houston Co., Ltd. It is the company's policy to rationalise manufacture preferably on a single product (or group) basis. The group business in electric lamps and lighting equipment is being rationalised in this way, the A.E.I. Lamp & Lighting Co., Ltd., integrating the sales of B.T.H., Metropolitan-Vickers and Edison Swan lamps and lighting equipment.

A new building is being erected to house engineering and development work alongside the existing large lamp factory at Melton Road, Leicester, and this activity will be concentrated there during the early part of 1958. Lamp manufacture is at present being rationalised in the factories at Leicester, Preston, Ponders End and Trent Vale, and in order to allow extension of apparatus manufacture in the Rugby Works, lamp manufacture in Rugby will ultimately cease. It is expected that lamp assembly will be transferred during the latter part of 1957 and early 1958. In a similar way tungsten and molybdenum wire manufacture will be transferred as the extension at Corby comes into operation in 1959.

Duties on Iron and Steel Products

Under the Import Duties (Exemptions) (No. 11) Order, 1955, and (No. 8) Order, 1956, the import duties on a wide range of iron and steel products were suspended until 18th March, 1957. After consultation with the Iron and Steel Board about the supply position, the Government has decided to prolong until 18th September, 1957, this suspension of import duty on the same range of products, with the exception of tinplate and terneplate, upon which duty is to be restored after 18th March, 1957. This is effected by the Import Duties (Exemptions) (No. 15) Order, 1956 (S.I.1863) (H.M. Stationery Office, 3d).

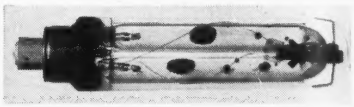
E.I.B.A. North Metropolitan Branch

The annual general meeting of the North Metropolitan Branch of the Electrical Industries Benevolent Association will be held at Northmet House, Southgate, N.14, on 11th January at 3 p.m. to receive the branch's annual accounts, together with the report of the committee; to elect members of the committee for the ensuing year; and to appoint all honorary officers. Nominations for officers should be submitted to the hon. secretary not later than 4th January.

Integral Sodium Lamps

Three new "Osram" integral sodium lamps, rated at 45 W, 60 W and 85 W respectively, will be marketed by the General Electric Co., Ltd., as from 1st January next. With the 140 W lamp, introduced in June, 1956, a complete range of integral lamps will be available to replace the old design using a detachable jacket. Typical of the many new installations using the 140 W integral lamp are those in the Metropolitan Borough of St. Pancras, at Bedwellty and at Bolton.

An advantage of the integral jacket



45 W Osram integral sodium lamp

construction is that reliable starting is ensured under all atmospheric conditions, because the arc tube is fully protected against the effects of damp and dirt. The one-piece construction also makes for easier lamp replacement and simplifies handling, transport and stocking problems. The list prices of the integral lamps are:— 45 W, £2 17s; 60 W, £3 2s 6d; 85 W, £3 16s; and 140 W, £3 19s.

Bathroom Fatality

Giving evidence at an inquest at Gilfach Goch, South Wales, recently Mrs. Phyllis Patterson said that her husband, who was found dead in the bath at his home, frequently used an electric fire in the bathroom. The guard of the fire was lying in the bath and her husband had burns on his body. The fire was near the bath. After Mr. A. Jones, of the South Wales Electricity Board, had stated that the wiring of the fire was faulty, the coroner stressed that wiring should be competently done and in any case of doubt an expert should be called in. He returned a verdict of "Accidental death."

Heating Appliances Exhibition

An exhibition of special interest to all sections of the British Transport Commission has been held during the past ten days at the showrooms of Allied Ironfounders, Ltd., 28, Brook Street, W.1. The exhibition, which concludes to-day (Friday), has been designed to display a cross-section of the appliances manufactured by the company and its subsidiaries, with particular emphasis on those appliances suitable for use in public waiting rooms and offices; signal boxes; platelayers' and crossing gate huts; welfare

centres at engine sheds; hotels, etc., and includes solid fuel, gas and electrical apparatus.

Electrical appliances on display include the "Falco-Petite" electric cooker, the "Firefly" electric heater, the "Falco" No. 41 electric heater, the "Falco-Freedom" electric cooker, and a new cooker shown for the first time, the "Falco-Buxton" cooker. This is described in our "New Electrical Equipment" section in this issue.

South African Railways Signalling Contract

A contract has been placed with the Siemens & General Electric Railway Signal Co., Ltd., by the South African Railways for relay interlocking and automatic colour-light signalling on new lines serving native townships in the Germiston-Angus area of the Rand, east of Johannesburg.

Automation in the Office

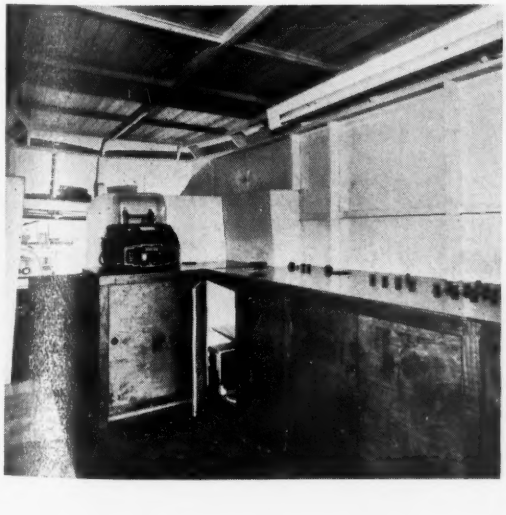
The Office Management Association of Great Britain announces that a special sub-committee of the Council has been formed, which will keep itself informed of all the latest developments in electronic equipment and in the application of such equipment to commercial work. The 1957 Conference to be held in Scarborough in May next aims to bring delegates up to date on the subject by dealing with the practical application of this equipment.

Special study groups which will be concerned wholly or partly with the subject have been formed or are in the course of formation in Birmingham, Bristol, Liverpool, London and Nottingham.

Mobile Testing Unit

The Yorkshire Electric Transformer Co., Ltd., is now operating a mobile testing division for carrying out tests after installation of units at power stations, etc. The interior of one of the vehicles is shown in the accompanying picture.

The interior of one of the vehicles of the mobile testing division of the Yorkshire Electric Transformer Co., Ltd.



Falk, Stadelmann in Glasgow

Falk, Stadelmann & Co., Ltd., acted as hosts to the Scottish electrical industry during last week to mark the re-opening in newer form of their showroom premises at 254-260, Clyde Street, Glasgow. The Lord Provost of Glasgow performed the opening ceremony on 4th December.

A corner of Falk, Stadelmann's Glasgow showrooms

In redesigning the premises the company has regarded them more as an information and design centre than in the past, in the belief that architects, consultants, contractors and engineers will find there the answer to their planning needs.

The entry is in traditional style, with rich veneered timbers and an information desk set in the foyer which leads to the showroom proper. A reception room has been created off this area for the comfort of visitors. The showrooms have been laid out on open access lines, so that it is possible to stand centrally and survey the entire area. The colour blendings are outstanding and provide a simple and effective background for the fittings. The whole layout is "contemporary" without being aggressively so. There are sections devoted to school, hospital, public building, industrial and domestic lighting.

Attending the official opening were Mr. Hugo Falk, chairman, Mr. C. J. Falk, sales director, Mr. E. V. Brown, director, Mr. J. Stewart, director, and Mr. F. S. Gilling, as well as staff and representatives from other areas.

In thanking the Lord Provost for opening the showroom, Mr. Hugo Falk paid a tribute to the work done by the late Mr. Greig, who controlled the Scottish branch for many years, and to Mr. Stewart who was carrying on the tradition. He said that the company was pledged to observe fair trading policies and all its business had been and would be done through trade channels.

Motor Fuel for Goods Vehicles

The Minister of Transport and Civil Aviation has issued to regional transport commissioners instructions concerning the issue of supplementary fuel rations for goods vehicles. These instructions set out the considerations which will govern the issue of supplementary rations. Summarised, they state that as much traffic as possible should move by methods other than road transport and supplementary rations should only be issued where the use of road transport cannot be avoided. Certain traffics and activities are listed to which special consideration will be given. Small "C" licence vehicles of one ton unladen weight and less will only be granted supplementary rations in exceptional circumstances. The Minister reminds operators that applications for supplementary rations must be made on Form Z/F/5B which can be obtained from the appropriate local office, the address of which is enclosed with the basic ration coupons.

Germicidal Tubes

Philips Electrical, Ltd., has published a fully-comprehensive booklet on the functions and applications of the ultra-violet germicidal tube, commonly known at the TUV tube. Entitled "Philips Germicidal Tubes For Food Protection," it is a 20-page publication with more than forty half-tone illustrations and diagrams relating to specific applications in the food industry. The booklet is available, free of charge, from Philips Electrical, Ltd. (Lighting Division), Century House, Shaftesbury Avenue, London, W.C.2.

Two Pye Contracts

The Independent Television Authority has placed a contract with Pye, Ltd., for the transmitter for the South Wales and West of England T.V. station, which will start operating towards the end of next year. It will be similar to the one at Lichfield and consist of a 20 kW vision transmitter and associated 5 kW sound transmitter; 5 kW vision and 1¼ kW sound transmitters are also being provided as standby equipment.

The Lichfield transmitting station of the I.T.A., which was designed and manufactured by Pye, recently increased its radiated power to 200 kW, making it the most powerful station of its kind in the United Kingdom, and bringing the total population within the Midlands service area to over six

million. To achieve this increase, a set of high-power (20 kW) amplifiers, employing special water-cooled valves, has been added to one of the sets of low-power transmitters. The other low-power set will act as a stand-by in the event of breakdown of the main transmitters.

The company has also received an order to supply and erect twin 3¼in diameter transmission lines on the masts of the B.B.C. stations at Kirk o' Shotts and Carlisle. Erection is due to commence next summer and the lines are to be used to transfer power from the 10 kW v.h.f./f.m. transmitters at the base of the masts to the slot aerials at the top. The height of the mast at Kirk o' Shotts is 750ft and that at Carlisle is 500ft.

Brush Sales Company in India

The Brush Group has formed a new company, Brush Export (India), Ltd., to assume responsibility for electrical sales in India from 1st January next. The new company will take over the Group's branch offices in New Delhi, Bombay and Calcutta. The directors will be Messrs. Miles Beevor (chairman) M. C. Clear, A. L. Cramb (general manager), P. Evans, L. C. W. Turner and H. F. Yelland.

New Trade Mark Rules

Some changes in the rules governing trade marks have been announced by the Board of Trade. The prohibition on the use of the Royal or Imperial arms in trade marks has been clarified. In particular such words as "Royal" and "Imperial" are no longer forbidden unless their use implies Royal patronage, past or present. The prohibition on the use of the word "Anzac" in trade marks remains in force.

The revision also includes an extension from one to two months of the period allowed in certain procedures where applications have to be made to the Registrar.

These changes are given effect by the Trade Marks (Amendment) Rules, 1956 (S.I. 1956 No. 1844), which came into operation on 30th November. Copies can be obtained from H.M. Stationery Office, price 3d (by post 5d).

Australian Tariff Inquiries

The *Board of Trade Journal* reports that the Australian Minister for Trade has referred to the Tariff Board for inquiry and report the question whether assistance should be given to the production of various goods. Among them are (*a*) refrigerating appliances and parts (Tariff item 176(F)(2)) and (*b*) radio receivers (180(E)), fixed resistors (179(C)), condensers (180(L)) and radio or television transformers (179(D)(2)(A)(I)(b)). Notification by United Kingdom interests of proposals to tender evidence has to be given to the Australian authorities by 22nd December. Trade associations and firms wishing to submit evidence should advise the Board of Trade, Commercial Relations and Exports Department, Horse Guards Avenue, London, S.W.1, quoting references (*a*) CRE 12,925/56 or (*b*) CRE 12,927/56.

Heat Testing of Aluminium Sheet

It is important for manufacturers exporting to tropical countries to know beforehand how their products will behave under tropical conditions. In such countries great variations often occur between day and night temperatures and for this reason tests were carried out for Northern Aluminium Co., Ltd., on their "Noral Snaprib" building sheet by Aluminium Laboratories, Ltd., Banbury.

Since this sheet is used extensively in the building trade for roofs and walls, it was desirable to have detailed information on the stresses likely to be created and the movements produced. "Metrovick" standard 3ft infra-red element projectors were used to form a 60 kW bank radiating vertically downwards on to the 20ft sections of sheeting. This provided a surface temperature of 190 deg F with an ambient temperature of 70 deg F.

The tests were successful in providing the information required and they incidentally demonstrated the effectiveness of aluminium's high heat reflectivity, a characteristic that is responsible for keeping the interior of aluminium buildings cool in the tropics. Thus, with the temperature of the sheet at 190 deg F a point 2in below it registered 90 deg F and a point 8in below only 72 deg F.

Standard 3ft "Metrovick" infra-red element projectors used to provide heat to simulate tropical conditions for "Noral Snaprib" sheet

Educational

A course of eight lectures on transistor physics and transistor applications will be held at the South East London Technical College, Lewisham Way, S.E.4, on Thursday evenings, commencing on 7th February. The fee for the course is £1 and particulars can be obtained from the head of the Department of Electrical Engineering and Applied Physics.

A course of seven lectures on "Acceptance Testing of Electrical Equipment for Power Supply Systems" will be held on Monday evenings, commencing on 21st January next, at the Manchester College of Science and Technology. The fee for the course is 30s and particulars can be obtained from the Registrar of the College, Sackville Street, Manchester, 1.

Calendars

Stewarts & Lloyds, Ltd., have sent us a neat desk calendar with monthly slips.

The calendar received from Lindsay & Williams, Ltd., has large daily slips mounted on a stout board bearing the company's trade mark "Megomoid."

The monthly sheets of the calendar of the Fischer Bearings Co., Ltd., have illustrations of British cathedrals. Each sheet shows the preceding and following months.

New Year Holiday

The works of Bruce Peebles & Co., Ltd., will be closed for the New Year holiday from 28th December to 3rd January.

Trade Announcements

Simmonds & Stokes (Niphan), Ltd., has appointed Mr. A. J. Burke, A.M.I.E.E., A.C.G.I., Bank Chambers, 51, Grainger Street, Newcastle-on-Tyne (telephone: Newcastle 22997), as its agent for Northumberland, Durham and the North Riding of Yorkshire.

Mr. Paul Hart, buyer for lighting and small domestic appliances for **William Whiteley, Ltd.,** has now taken over the purchasing of heavier domestic appliances.

The Aberdeen sales office of **Brook Motors, Ltd.,** is now at 1, Bon Accord Crescent, Aberdeen (telephone: Aberdeen 21890).

Ekco-Ensign Electric, Ltd., has moved its East Midlands branch to larger premises at 27, High Pavement, Nottingham. Mr. Philip G. Bush is the East Midlands branch sales manager.

SWEDEN'S ELECTRICAL TRADE

A Buyer and Competitor

HER wealth of natural resources and high industrial development, coupled with the benefits of an uninterrupted period of peace stretching over more than a hundred years, has secured for Sweden's population a higher standard of living than any other European nation. Always endeavouring to extend her foreign trade, not only in wood products, but also in the goods of her competent electrical industry, she nevertheless depends largely on imports, as shown in Tables 1 and 2 (14·4 kr.=£1).

TABLE 1.—SWEDEN'S ELECTRICAL TRADE BY COUNTRIES (mill. Swedish kr.)

Countries	Imports 1954	Imports 1955	Exports 1954	Exports 1955
United Kingdom	53·4	61·5	6·8	9·6
Norway	4·9	6·5	32·5	34·5
Denmark	19·6	23·2	20·9	25·7
Iceland	—	—	1·1	2·7
Finland	0·5	0·4	16·0	19·1
Russia	—	—	10·2	5·7
Poland	0·9	1·2	13·9	11·7
E. Germany	0·8	0·5	—	0·1
W. Germany	153·5	189·9	4·9	9·8
Holland	52·2	57·8	16·6	15·5
Belgo-Lux.	4·6	7·1	5·4	7·2
France	7·6	6·9	5·1	7·1
Spain	—	—	10·4	9·9
Portugal	—	—	2·5	3·0
Italy	2·3	1·9	9·4	8·7
Switzerland	18·6	15·2	4·5	4·6
Austria	2·5	3·1	3·4	4·9
Czechoslovakia	0·5	0·3	0·7	0·3
Hungary	1·2	1·2	0·7	0·4
Jugoslavia	—	—	9·8	1·5
Turkey	—	—	4·0	8·2
Greece	—	—	1·7	0·9
S. Africa	—	—	3·5	4·4
Iraq	—	—	0·4	0·5
India	—	—	3·1	5·9
Pakistan	—	—	0·8	2·0
Australia	—	—	9·1	4·4
N. Zealand	—	—	4·8	3·4
Egypt	—	—	3·6	10·2
S. Arabia	—	—	1·3	5·0
Iran	—	—	1·1	1·8
Indonesia	—	—	3·7	1·5
Canada	0·2	1·0	4·3	7·0
United States	28·0	38·5	12·7	6·1
Mexico	—	—	28·2	12·9
Venezuela	—	—	8·3	8·7
Brazil	—	—	14·3	9·9
Uruguay	—	—	3·7	2·2
Argentina	—	—	9·4	2·1
Chile	—	—	1·4	1·2
Bolivia	—	—	0·7	4·7
Peru	—	—	2·1	3·4
Ecuador	—	—	3·3	2·1
Colombia	—	—	14·3	20·3
Japan	0·4	3·5	0·8	0·2
Total	352·4	420·7	329·6	331·1

TABLE 2.—SWEDISH ELECTRICAL TRADE IN 1955 BY GROUPS

Group	Exports kr.000	Imports kr.000
Generators and motors	65,253	55,288
Starting, regulating and protective equipment	21,195	30,452
Cables and wires	13,044	51,345
Porcelain insulators	—	4,179
Accumulators	14,854	3 239
Galvanic cells	—	4,133
Lamps	3,282	27,171
Carbon products	520	15,550
Telegraph and telephone equipment	99,690	5,337
Radio equipment	13,153	55,877
X-ray tubes	829	2,552
Fans, vacuum cleaners, floor polishers, washing machines and dishwashers	47,610	46,900

The attractive sales possibilities in this important market may be gauged by the fact that the number of telephones and radio sets per head is, with the exception of the United States, the world's highest. Although since 1951 Western Germany and Holland have re-entered the Swedish market successfully, mainly with telecommunication and other electronic products, Sweden remains one of the United Kingdom's leading European markets. The large volume of British electrical exports to Sweden is based on the complementary economies of the two countries, backed by a long-standing goodwill for British products. Details of last year's United Kingdom electrical exports to Sweden are listed in Table 3. It will be seen that domestic appliances are in the lead.

Though Sweden represents a valuable market for United Kingdom electrical products, she has also proved a very formidable competitor. She has not only managed to penetrate traditional British markets, but also Russia, her satellites and, according to reports, Communist China, mainly with prime movers and substation and telephone equipment (Table 4).

Within the Swedish electrical industry, the A.S.E.A.

TABLE 3.—U.K. ELECTRICAL EXPORTS TO SWEDEN IN 1955

Class	Value £000	Class	Value £000
Diesel generating sets	40	Hearing aids	4
Steam turbo sets	10	Cookers	2
Steam engines	2	Space heaters	39
Generators	12	Parts of cookers and space heaters	142
Generator parts	4	Flat irons	39
Motors under 1 h.p.	385	Vacuum cleaners	14
,, 1–250 h.p.	29	Floor polishers	2
,, over 250 h.p.	2	Hair clippers and dry shavers	123
Parts of motors	25	Fans	17
Convertors, rotating	3	Washing machines up to 150 lb	358
Transformers	46	Ditto, 150–250 lb	5
Switchgear	11	House service meters	6
Mercury arc rectifiers	13	Time recorders and switches	6
Arc welding plant, a.c.	4	Commercial instruments	64
,, ,, ,, d.c.	2	Scientific instruments	149
Welding electrodes	14		
Electro-medical apparatus	21		
X-ray appliances	9		

TABLE 4.—MAIN MARKETS FOR SWEDISH PRIME MOVERS AND ELECTRICAL MACHINERY (Kr.000)

Class	1954	1955
Steam turbines	20,145	16,317
Finland	6,884	6,032
Russia	136	850
Poland	2,236	2,037
Belgo-Lux.	1,242	755
France	306	844
Italy	776	813
Jugoslavia	190	518
Port. West Africa	—	224
S. Africa	259	356
India	585	484
Pakistan	17	345
Thailand	54	284
Japan	241	688
Canada	358	82
Argentina	620	163
Brazil	1,388	273
Mexico	1,007	23
Australia	10	293
Water turbines	9,297	8,652
Norway	1,312	1,320
Finland	10	24
Russia	983	18
Spain	2,819	2,075
Jugoslavia	101	1,917
Egypt	2,459	2,413
Brazil	211	702
Colombia	23	106
Canada	1,066	—
Motors and generators above 3 tons	17,470	17,436
Norway	735	435
Denmark	810	754
Finland	1,540	504
Russia	918	1,515
Poland	1,171	434
W. Germany	—	515
Belgo-Lux.	429	423
Spain	2,958	4,533
Egypt	2,083	3,743
S. Africa	26	115

Sweden's Electrical Trade *(continued)*

Class	1954	1955
Motors and generators above 3 tons *(continued)*		
India	249	87
Pakistan	199	328
Canada	373	2,156
Brazil	295	199
Motors and generators: 500-3,000 kg	7,763	7,262
Norway	1,185	1,255
India	212	678
Finland	330	578
Ditto, 100-500 kg	4,978	5,465
Norway	1,520	1,336
Mexico	478	545
Denmark	263	372
Ditto, 50-100 kg	1,662	1,430
Norway	562	479
Mexico	76	92
Uruguay	88	73
Ditto, 25-50 kg	1,561	2,576
Norway	619	637
Holland	125	320
Hongkong	34	233
Ditto, 10-25 kg	1,746	1,636
Norway	539	398
Holland	208	287
Mexico	126	228
Ditto, up to 10 kg	5,179	4,479
Denmark	2,362	1,995
Finland	83	453
Austria	780	755

group plays an important part. The group comprises the following manufacturers: Ljungström (turbines), Liljeholms (cables), Surahammar Bruks (steel), Svenska Flatfabriken (fans and air-conditioning plant), and Helios (heating and domestic appliances). Last year the group exported about 21 per cent of its total orders, and provided Australia, India, Spain, Poland, Communist China and Finland with heavy plant and materials.

The export success of Sweden's electrical industry is mainly based upon a sound home market. High productivity is attained by the employment of the latest machinery and materials. Her commercial flexibility, competitive prices, attractive delivery terms and extended credits, coupled with a vigorous sales policy, make her a country to be reckoned with.

An extensive municipal building programme is in hand and is likely to increase the demand for domestic appliances. Television equipment, radio components, and apparatus for the Swedish Atomic Energy Commission, should form potential outlets for United Kingdom manufacturers.

New L.C.C. School

BUILT at a cost of over £600,000, a new L.C.C. comprehensive school in Upper Tulse Hill, Lambeth, is the tallest school building in London and probably in the country. It is of nine storeys and, standing on high ground, commands fine views of Central London, Surrey and Kent. Accommodation is provided for 2,000 boys.

From the main cubicle in the workshop block p.i.l.c. and m.i.c.s. cables run in service ducts to the several blocks. In the teaching block the cables terminate at the ground floor in two separate rising main systems extending to the top of the nine storey building. The rising mains consist of two sets of insulated copper rod, one for lighting, the other for general purpose circuits terminating at each floor at distribution boards housed in cupboards in the corridors. Subcircuits are wired with p.v.c. cables, enclosed in heavy gauge conduit, or m.i.c.s. cables. There are more than 2,070 lighting points, 340 sockets, 135 clocks, 30 fire alarm points and 80 motors and machines having a connected load of over 930 kW. Classroom lighting follows the general pattern of nine 150 W lamps in "Perspex" reflectors and a blackboard trough fitting with four 60 W lamps, whilst biology, art rooms and drawing offices are lit with "new warm white" fluorescent tubes in plastic reflector fittings. Illumination in the assembly hall is from 45 300 W lamps in recessed fittings with louvres.

Each of the five gymnasia has eight totally enclosed 500 W "Perspex" fittings with a quick release mechanism which enables the complete fitting to be installed from the ground with the aid of a special pole.

All clocks are of the impulse pattern which, together with the combined schools broadcast, class-change, public address and fire alarm systems, are controlled from the radio room on the teaching block ground floor.

The teaching block has four 30-person 150 ft/min passenger lifts which, in the event of the fire alarm sounding, automatically return to the ground floor and remain inoperative.

The specification for the electrical installation was prepared and the work supervised under the direction of Mr. J. Rawlinson, C.B.E., chief engineer to the L.C.C., assisted by Mr. C. A. Belcher, M.I.E.E., divisional engineer, and Mr. R. Plummer, M.I.E.E. The sub-contractors included H. J. Cash & Co. (electrical installation); Artic Fuse & Electrical Manufacturing Co. (main intake panel and fuse gear); British Klockner Switchgear (boiler control panel); Magneta Time Co. (impulse clocks and class-changing systems); Major Equipment Co. (stage lighting control panel); Clarke & Smith (radio and staff communication systems); and Hammond & Champness (lifts).

Air Pollution Sources

RESULTS of a seven-year investigation into the sources of pollution of the atmosphere, which in Great Britain causes damage estimated at £250 million per annum, were reported on 28th November to the Institute of Fuel by Dr. R. S. Scorer (London University). Effluents, from different sources, he said, were dispersed in different ways, so the harmful effects did not depend mainly on the amounts emitted but rather on five factors: height, temperature and bulk nature of effluent; radiative effects of suspended pollution; concentration of output during adverse weather; closeness to site of damage; and chemical nature.

A rough estimate of damage per ton of fuel consumed (with the annual totals in millions of tons in brackets) was: industry, £0·16 (44); domestic, £6 (37); electricity, £0·03 (36); railways, £0·7 (14); collieries, £0·23 (10); other users of coal, £0·35 (11); oil for road traffic, £1·6 (10). If smokeless fuel alone were used for domestic purposes, damage would be decreased by £100 to £140 per annum. At present all-electric domestic heating would effect a great national saving even if the thermal efficiency of power stations were only half that of a grate.

The most important single influence in the removal of pollution was horizontal wind. At low wind speeds and in stable conditions turbulence was almost negligible; vertical displacements of the effluents and their mixing due to buoyancy were then paramount. If plumes from all sources were conical with horizontal axes, a 10 metre chimney would produce a concentration 50 times that from a 70 metre chimney (the typical height for an electric power station), but low-level plumes mixing with air below chimney-top level, owing to eddies produced by airflow over buildings, increased the effect of height. Temperature became more important with larger outputs of effluents if hot, but a large source of cold effluent must be guarded against. Gas washing at electric power stations, even if it were capable of removing all harmful pollution, could not save, by reduction in damage, more than £0·03/ton of fuel consumed against an actual operating cost of the washers at Battersea and Fulham power stations of about £0·5/ton, so that nationally the effort was wasted. Attempts by the Central Electricity Authority to measure increases of pollution near new power stations had generally failed, presumably because the pollution never rose above the variations in that already existing locally.

METER READING

Partial Mechanisation Suggested

By G. T. SHEARS, A.M.I.E.E.

THE process of reading consumers' meters has changed very little since the beginning of the electricity supply industry at the turn of the century. It is still necessary for a man to call at each supply terminal and write down in a book the meter index. The information thus obtained is used in the office to calculate the account and although mechanisation of the accounting procedure has occurred the entire basis of invoicing depends upon the entry by the meter reader.

While there is no general cause for complaint about accuracy a wrong entry is likely. A suspected error means revisiting the consumer's premises to verify the meter reading. The actual operation of meter reading may be difficult because of the situation of the instrument. The reader must have book, pencil and flashlamp and must remember the index figure for a second or two whilst exchanging flashlamp for pencil with which to write in his book. These operations take time and as the procedure is repeated at each supply terminal the overall speed of meter reading, bearing in mind the need for accuracy, cannot be high.

The proposal outlined suggests that meter dials should be photographed and the indelible record used in place of the written entry in the meter book. A camera constructed as shown in Fig. 1 would reduce meter reading to a one-handed operation requiring no checking or second thoughts. The reading time would be much less and the record would have photographic accuracy. The film could easily contain several hundred readings without making the camera too heavy or cumbersome. The battery for the lamp could be within the pistol-grip handle and an indicator showing the number of film frames available should be incorporated. Where more than one meter was installed it would be necessary, of course, to take additional pictures and also to photograph maximum demand indicators separately.

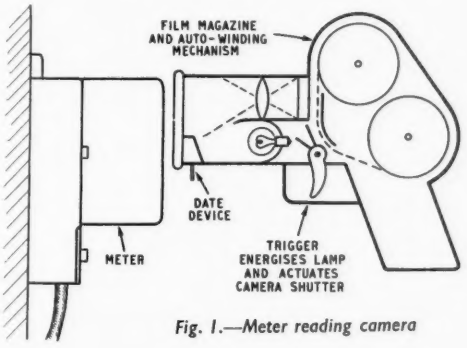


Fig. 1.—Meter reading camera

On completion of the film, or as necessary, the camera would be unloaded and the film developed. Printing would not be required as the developed film could be projected on to a screen for interpretation and subsequently stored in a small space. The actual projection would be negative but this should not affect definition or interpretation adversely. The size could be much enlarged but about three diameters would seem to be an appropriate magnification and would allow the screen to be of reasonable dimensions.

A mechanism would be included in the camera so that each picture had superimposed upon it the date on which it was taken—an essential detail to make complete accounts. The identity of the consumer is not usually marked on the meter but to employ this scheme the consumer's number must come within range of the camera.

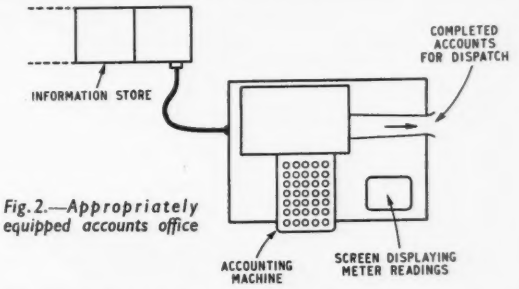


Fig. 2.—Appropriately equipped accounts office

Having followed the process up to the point of showing the meter reading on a screen in the office it is worth considering the ultimate possibilities of such a scheme. Clearly, it would be pointless to copy the figures from the screen into a ledger since an indelible record already exists. It is reasonable to assume that the displayed information could be typed straight into a suitable calculating machine designed to do the arithmetic. At once there is the consideration of other items such as fixed charges and purchases which must be included in the account and the machine must have prior knowledge of these. Also, the machine must know the previous meter index so as to deduce the energy consumed by subtracting the readings one from the other.

Some form of information store is essential and there are several well-tried methods in use for other purposes to-day. If the first operation was to type the consumer's number, the machine would select that consumer's record and use the added data to produce a complete electricity account.

In Fig. 2 is the plan of an office equipped to deal with electricity accounts in the manner described. It is easy to picture the possibilities and speed of such a single-operator machine. Statistics and account figures could be obtained from the " memory " without prejudicing the operation of the meter reading scheme. The construction of suitable calculating machinery is well within the ability of firms in this country.

There remains the meter photography technique which may warrant investigation separately as it is not confined in application to electricity meters alone.

Retention of Trams

THE *Municipal Journal* reports that because of the fuel crisis, Glasgow Corporation trams, due for early withdrawal, will not be taken out of service until the position improves. Trams may also continue to operate on routes in Leeds where their replacement by buses had been planned.

Factories in 1955

Annual Report of H.M. Chief Inspector

IN the annual report on the work of the Factory Department of the Ministry of Labour and National Service for the year 1955, Sir George Barnett, H.M. Chief Inspector of Factories, mentions that since 1954 the factory population has increased by 2·5 per cent, the number of factories with mechanical power by 0·4 per cent, and the number of accidents in factories by 1·2 per cent—from 161,458 to 163,332. The accident rate, however, was the lowest yet recorded, the index being 89·2 (1950 taken as 100). With the exception of a slight increase in 1953 it has decreased every year since the war.

Mechanisation and automatic control of factory processes of all kinds is becoming more and more widespread. The Chief Inspector considers that the cumulative effect on production and on working conditions of a number of such changes in relatively small items is probably much greater than that of the more obviously impressive examples of full automation in the larger plants. Whatever the plant or the degree of automatic control, it is always important to ensure that control mechanisms have the characteristics necessary for safety. This can best be done in the initial stages of design, and the Factory Department is willing to give advice in this as in other fields.

Safety Methods

Of accident prevention organisation the Chief Inspector says that unless a genuine and continuing interest in accident prevention is shown by top management, accident prevention schemes, however excellent on paper, are doomed to stagnation and ultimate failure. Explaining that the increase in the accident rate for women since 1953 is due to the general increase in the numbers of women employed, consisting largely of "green" labour, Sir George says: "I should like management to ask themselves what they are doing to protect the ex-housewife, shop or office worker who finds herself for the first time in a factory against the consequences of her unfamiliarity with her environment. In many cases, it would appear to be no one's business to explain to her the very ABC of taking care of herself by means of safe methods of working and the wearing of suitable clothing. This might not necessarily be due to lack of goodwill at the top but might occur because the individual primarily responsible for the organisation had become hard-pressed with other duties."

Although nuclear sources of energy for industrial power supply are becoming a major development, new ways of thinking about instrumentation, control, and the handling of information as well as of materials, together with changes in economic factors, are likely to produce changes more drastic than even the development of nuclear power stations. Important electrical and electronic developments are now taking place, even in the heavier industries. For instance, it is possible that a major revolution is beginning in the manufacture of steel. "If we assume that in time the whole operation of the manufacture of steel will be supervised by a few technicians," states the report, "and that except for maintenance work, practically all the heavy and dirty work will be eliminated, we shall probably not be over-estimating the developments of the next few years."

The installation of new generating plant continued on a large scale during the year, there being an increase of 1,922 MW in total installed capacity, equivalent to 9·3 per cent of the total capacity at the end of 1954. Attention has previously been drawn to the unsatisfactory design and arrangement of some switchgear and control panels for station auxiliaries, and inspectors continued to find causes for complaint in this respect. Criticism has also been directed against auxiliary switchgear of the "quart in a pint pot" type, where the main factors in design appear to be saving in space, and possibly in cost. While reduction in the size of switchgear panels is desirable in itself, it may often be gained at the expense of facilities for easy and efficient maintenance.

A further point of interest is the continued occurrence of accidents at "isolated" switchboards or cubicles through electricians, or semi-skilled men, coming into contact with live conductors in the ordinary course of work.

There have again been several fatal and many non-fatal accidents due to accidental contact with the h.v. and m.v. overhead distribution lines of Area Boards. Not all of these were reportable under the Factories Acts; those which were so reportable occurred on factory premises, building operations and works of engineering construction.

During 1955 electrical accidents numbered 739 (42 fatal) compared with 707 (33 fatal) in 1954. The report shows that 25 of the total of 42 fatal accidents occurred at voltages not exceeding 250 V. Many people, including some electricians, still assume that the risk at this voltage is negligible. Table 17 of the report shows the numbers of accidents which were associated with different types of equipment. These figures do not differ materially from those of the previous year. Attention is again drawn to the high proportion of accidents arising from the use of portable electrical equipment. From year to year in this report it has been emphasised that if lower voltages were more generally adopted for portable equipment the number of accidents and, in particular, the number of fatalities, would be very substantially reduced.

Instruments and Control

A NEW publication of the Federation of British Industries, "Applications of Instrumentation and Automatic Control," which is available from the Federation at 5s per copy, has been compiled as a general guide to the principles and means of application of instruments and controls generally used by the manufacturing industry for steam raising and industrial processes. The text of the booklet was written by Mr. A. Linford, B.Sc., for the British Industrial Measuring and Control Apparatus Manufacturers' Association which provided it for the Federation.

In the introduction it is pointed out that, in spite of the inestimable value of measuring instruments, a surprisingly large number of factories and boiler houses are operated with the bare minimum of instruments demanded by statutory regulations and it is emphasised that in the design of new plant particular attention should be paid to the possibilities presented by the incorporation of automatic control. Such control releases labour for other duties and its use will result in a better and more consistent final product.

GENERATION AND DEVELOPMENT

Electricity on Farms

The South of Scotland Electricity Board's plan for completing the rural electrification of the District was discussed by the Consultative Council at its meeting in Edinburgh on 3rd December, when Councillor J. Sullivan, C.B.E., presided. The Council agreed to recommend to the Board that every effort should be made to induce farmers to electrify their premises by the employment of advisers trained or experienced in farming processes and capable of demonstrating the benefits of electrically operated equipment in agriculture. Several members commented on the favourable terms offered and the recent recognition in the Government's White Paper that modernisation of farms offered the best way of making an effective contribution towards lowering production costs. It was pointed out that where farm buildings were reconditioned and a supply of electricity for agricultural purposes was provided, a grant of 33⅓ per cent of the total cost might be payable for all the main permanent improvements.

Board's Charging Methods

Another matter considered by the Consultative Council related to the South of Scotland Board's practice of issuing accounts based on estimated consumptions, which the Council had approved at an earlier meeting. The Council hoped that consumers would co-operate in making a success of this economy measure which would reduce meter reading costs and be in the best interests of consumers; the estimates were reasonably accurate. A representation from Kirkcaldy, concerned the inclusion of the "dinette" (Weir type of house) as a chargeable room under the Board's domestic tariff. It was emphasised that local authority definitions had no bearing on the matter. By basing the domestic tariff on the number of rooms in a dwelling house the Board ensured that consumers made some contribution towards the capital and other fixed costs relating to the maximum demand created by each consumer.

Future of Manx Electric Railway

A committee appointed by the Tynwald to consider the possibility of continuing the Manx Electric Railway has recommended that it should be purchased by the Manx Government. The provisional purchase price is £50,000. A programme of track relaying, renewals and maintenance costing £225,000 over a period of ten years is proposed. At the end of that period, the committee recommends, the question of relaying the Laxey to Ramsey section should be considered. If this section were retained the cost of the undertaking over twenty years would be £744,000.

Network Reconstruction

Durham R.D.C. has approved plans submitted by the North Eastern Electricity Board for the reconstruction of the former National Coal Board network at Ludworth. Plans by the Electricity Board for a 20 kV overhead line to Trimdon Grange Colliery have also been approved.

"All-Electric" Flats

South Shields Housing Committee is recommending that 243 flats to be built in the Laygate Street area of South Shields should be "all-electric."

Washing Machine Tax "Unjustifiable"

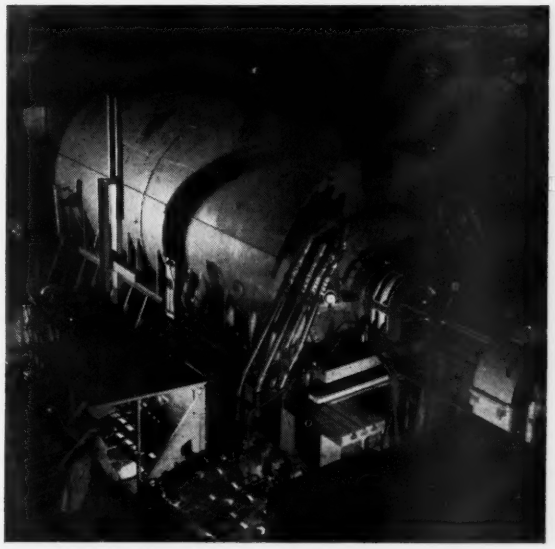
The East Midlands Electricity Consultative Council, at its meeting at Nottingham last week, decided to make a renewed plea for the removal of purchase tax on electric washing machines which, on social and economic grounds, the Council considered to be completely unjustifiable. It was pointed out that industry had adopted labour-saving machinery on an extensive scale in order to economise in time and effort and the housewife should be given the opportunity of acquiring, at a reasonable price, the most labour-saving appliance which could be used in the home.

Willington "A"

Good progress is being made in the construction of the 400 MW Willington "A" generating station of the Central Electricity Authority, which is on a 200 acre site near Derby. The first of the 100 MW English Electric alternators has been tested at the company's Stafford works and dispatched to the site.

The station is of semi-outdoor design with the boiler plant somewhat after the style of that at Ince, which was described in the *Electrical Review* of 5th August, 1955. Each of the four International Combustion boilers will be p.f. fired and have a rating of 830,000 lb/hr. The turbines are of the three cylinder impulse reaction type designed for steam conditions at the turbine stop valve of 1,500 lb/sq in and 1,050 deg F with the condensers operating at a vacuum of 28·9in Hg with feed heating to give a final feed temperature of 410 deg F at continuous maximum economic rating.

Adjacent to this station, Willington "B" will be constructed at some time in the future and this will have an installed capacity of 400 MW consisting of two 200 MW sets operating with steam at 2,350 lb/sq in and 1,050 deg F with reheat to 1,000 deg F.



English Electric 100 MW set under test at Stafford

Electricity and Highland Industries

Representations that there should be cheaper electricity rates in the area of the North of Scotland Hydro-Electric Board, especially for the purpose of attracting new industry, were answered by Sir George McGlashan, chairman of the Electricity Consultative Council for the North of Scotland, when members of the Council recently met a deputation from northern local authorities. Sir George McGlashan said that the Board's industrial tariff compared very favourably with those of other Boards in the United Kingdom, and with those charged in Glasgow. The Board's revenue from industrial consumers in the area last year was 1·3978d/kWh, whereas the Board sold to the Central Electricity Authority and the South of Scotland Electricity Board power at 1·773d/kWh.

Stating that it had been suggested that the electricity charges were not conducive to the extension of existing industries, Sir George pointed out that the cost of electricity was a very small

factor in industrial production so far as the gross value of the products were concerned. Transport costs militated much more against any attempt to attract new industry to the Highlands. Many industries, nevertheless, had been started throughout the Board's area. Some of these were as a direct result of the Board's encouragement and assistance.

OVERSEAS

Additional Power for Quebec

The first 60 MW of power from the Quebec Hydro-Electric Commission's Bersimis River project was supplied to the Shawinigan Water & Power Company on 1st December under a contract for the purchase of 300 MW from the Commission. The company also reports that good progress has been made on the construction of its new 246 MW Beaumont generating station on the St. Maurice River, ten miles upstream from La Tuque. Some 1,100 men are now at work on the project. Excavation of the by-pass channel is proceeding rapidly and this portion of the development will be completed and ready for temporary diversion of the river early in the spring. Preliminary work on the cofferdams has already started.

New Bahamas Authority

As from 1st October, 1956, the Bahamas Government Electrical Department has been transferred to a public corporation. The general manager is Mr. A. Kennedy.

Japanese Power Company Loan

A loan agreement establishing a credit of $8½ million in favour of the Kyushu Electric Power Company of Japan was signed recently at the Export-Import Bank of Washington. This will assist the Japanese company to complete its purchase of a 156,250 kW generating unit from the Westinghouse Electric International Co. This is in fact the fourth credit authorised by the Eximbank to a Japanese power company in recent months and brings the total of these credits up to $34 million.

Durance Hydro-Electric Scheme

Particulars of the project for harnessing the Durance River, a tributary of the Rhone, which was put in hand last year, were given at a joint meeting of the Institution of Civil Engineers and the Société des Ingénieurs Civils de France on 6th December. Mr. Raymond Giguet (joint director-general, Electricité de France) estimated the mean annual potential energy of the Durance at 10,000 million kWh of which more than half could be produced economically, the remainder being left for later development.

The whole project, he stated, provided for three new dams and 24 hydro-electric stations. In the first stage the lower Durance Canal would feed five power stations with a combined annual output of 3,200 million kWh and a dam, in the form of a dike 120 m high composed of compacted alluviums with a water-tight core, would be constructed at Serre Poncon at a total cost of £114 million, less £5 million contributed by the Ministry of Agriculture. The largest station, situated underground at the dam, would contain four vertical sets of 360,000 kVA in the aggregate operating under 128 m head and generating 700 million kWh/annum. Its essential function would be to regulate the river flow. The four other stations, operated under heads of from 31 to 113 metres, would have a combined rating of 525 MW.

Production of electricity was only one purpose of the Durance scheme, which was primarily to benefit agriculture. In ten years' time, when the last of the projected power stations would be going into service, the output of the whole chain would probably represent only 3 or 4 per cent of the whole country's consumption. Even with the addition of 2,000 million kWh expected to be available from the middle Durance the contribution would not be great.

Electricity on the Poultry Farm

With the extension of electricity supplies to more and more rural areas there is a steadily growing demand for electrical equipment for the poultry farm and it was not surprising, therefore, that many of the latest labour-saving appliances exhibited at the eleventh National Poultry Show, organised by *Poultry World* and the *Farmer and Stockbreeder*, which was held at Olympia last week, were electrically operated.

On the stand of the British Electrical Development Association it was emphasised that electricity provides the ideal source of power for all incubation needs, from the smallest table model to the largest cabinet installation. Thermostatically controlled heating, automatic turning, positive humidity control and air circulation ensure maximum hatch and thus increase productivity. Among the many appliances exhibited on the E.D.A. stand were a 100-egg observation table incubator, a 1,000-egg incubator, an electric hen brooder with a capacity of 100 chicks, a two-tier brooder with a capacity of 300 day-old chicks, and infra-red lamps of both the bright and dull emitter types.

It was demonstrated that with time-switch-controlled lighting winter egg production can be increased, and that an electric extractor fan can solve the problem of providing adequate ventilation. Other exhibits included an electric debeaker, poultry pluckers, an electric volatiliser for discouraging pests, and an alarm for giving warning of any supply interruption or temperature variation in the brooder house.

One of the highlights of this year's show was the final of a Champion Country Cook Competition. The preliminary round, for which there were more than 1,000 entries, was held in September, and on Friday each of the twelve finalists was required to cook a two-course meal for four at a cost of not more than 25s per meal. Three meals were cooked simultaneously in separate kitchens, one on a "Creda Carefree" electric cooker, one on a gas cooker and one on a solid-fuel cooker. The first prize of £50 was won by Mrs. Molly Hooton, of Holbeck Farm, Lincs. (solid-fuel cooker), the second prize of £25 by Mrs. D. E. Hobbs, of Penhole Farm, East Taphouse, Liskeard, Cornwall (electric cooker); and the third prize of £10 by Miss C. Clark, of Elstow, Bedford (electric cooker). The runner-up was Mrs. F. K. Rose (gas cooker). The prizes were presented to the winners by Miss Gwen Berryman, who plays the part of "Doris Archer" in the radio serial.

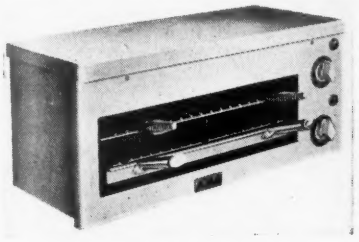
The E.D.A. stand at the National Poultry Show

NEW ELECTRICAL EQUIPMENT

Catering Grill

A new grill specially designed for back-bar catering has been added to the range of catering equipment manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It will cook approximately 10 chops or steaks in about seven minutes, or toast 10 slices of bread in two minutes. Modern in appearance, the grill front is finished in easy-to-clean mottled grey vitreous enamel. The side and back are finished in plain grey vitreous enamel.

The grill (model HO.40) has two switches, each with a pilot light. The elements consist of five 750 W panel



G.E.C. back-bar catering grill

units arranged to give all over heat even at half intensity. A grill pan, with separate grid and wire mesh toasting rack, is supplied. The dimensions are 27in long by 12in high by 11¼in wide and the grilling area is 21in by 10in. The price is £25.

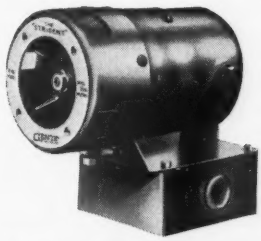
Illuminated Ceilings

In addition to the stove enamelled steel framework now being supplied, aluminium framing and components for their architectural lighting system have now been introduced by LUMENATED CEILINGS, LTD., Alliance House, Caxton Street, London, S.W.1. The new aluminium track and components are available without any increase in price, although an extra charge is made if the equipment is required to be anodised.

The reduction in weight, from 12 to 5 oz per sq ft, will allow certain structural economies, while the attractive qualities of the new track's exposed soffit, which has a rippled or "fluted" pattern on its polished surface, enhances the appearance of an installation, particularly as the width of the track is reduced to less than 2in. The T-shaped junction plates formerly used to connect the framework track have now been replaced by concealed connectors, which allow the framework to be neatly mitred without screws. Continuous lengths of track can be achieved also by using these connectors, the lengths being held firmly together with a butt joint. The corrugated translucent vinyl sheets are now retained in the framework by quick-sliding open track sections. By these means, the actual assembly and erection of a "Lumenated" ceiling have been greatly simplified. Acoustic baffles which can be used in conjunction with a "Lumenated" ceiling without requiring additional ceiling space in the horizontal plane have also been introduced.

Fire Alarm Siren

The latest addition to the range of sirens manufactured by GENT & CO., LTD., Faraday Works, Leicester, is a miniature model, the "Strident." It has a high frequency note of 800 c/s which makes it especially suitable



Gent & Co.'s "Strident" fire alarm siren

for use in overcoming high industrial noise levels and particularly effective for use as a fire alarm signal. The audible range is approximately ¼ mile in the open air.

The totally enclosed continuously rated motor, suitable for indoor use, operates on 200/250 V a.c./d.c. with a consumption of approximately 0·75 A. The siren is very compact, measuring 5½in long by 5⅜in high by 3½in wide, and is finished in red enamel. Of particular interest is the use of a box as the base which is drilled for ¾in conduit, on opposite sides for through wiring, and fitted with knockouts. This base box can be turned through 90 deg to conform to the run of the conduit. The price of the siren is £7 8s 6d.

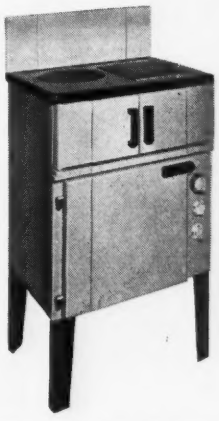
Spot Galvanometer

A recent development of EVANS ELECTROSELENIUM, LTD., Harlow, Essex, is a highly sensitive, taut suspension galvanometer with many advantages, the foremost of which are robust construction and dustproof sealing. The result is a unit that will withstand rough treatment, and which eliminates coil "stiction" or non-linearity, through the entry of dust into the air gap. The "Unigalvo" can be supplied in two models: type 15, a current or voltage measuring unit with range switch and terminals, and type 20, a current measuring unit with stabilised power supply to facilitate the use of external photo-electric measuring instruments. The standard instrument has a scale sensitivity of 330 mm/μA, but other sensitivities can be arranged. A range switch is fitted to permit full 1/10, 1/100 and 1/1,000 sensitivity. If requested, the instrument can be precisely calibrated and the scale marked in μA or μV at a nominal charge.

"Unigalvo" spot galvanometer

Electric Cooker

At the exhibition of industrial and domestic heating appliances being held by Allied Ironfounders, Ltd. (reference to which is made elsewhere in this issue), a new electric cooker, the "Falco-Buxton," made by the FALKIRK IRON CO., LTD., Falkirk, has been on show. This has a cooking capacity for up to five persons and its overall dimensions are 35¼in high, 22in wide and 18in deep. The oven has a loading of 2 kW and the interior is finished in vitreous enamel. The door opens from the side, and the oven may be thermostatically controlled or fitted with thermometer and 3-heat switch. The cooker has a boiling plate and grill boiling plate. The former can be of the solid or radiant type, and has a diameter of 8in; each can be fitted with a simmering device if required. The grill boiling plate measures 10½in by 8in and has a loading of 2 kW. There is a large hotcupboard. The cooker is finished in grey mottled vitreous enamel or cream mottled vitreous enamel, with black hob. The price is from £24 10s 6d.



The "Falco-Buxton" cooker

Financial Section

STOCKS and SHARES

EVENTS can still swing Stock Exchange markets from one tack to the other without much notice, but have given them, in the first part of this month, further opportunities to display their resilience. Admittedly in these thin markets a small amount of business is apt to produce an exaggerated effect on prices. It is to be noted all the same that buying needed recently to be on only a very moderate scale to disclose a general shortage of good stock. This confirmed the impression that no heavy selling took place during last month's periods of greatest anxiety. Markets could be said to have established a firmer footing while awaiting the unfolding of developments in the international field and in facing the economic consequences of the fuel shortage at home.

Nuclear Energy

Shares of the big electrical engineering groups reacted strongly to indications of the Government's intention to enlarge and accelerate the programme for nuclear power development. Associated Electrical Industries' shares were up to 67s 6d, at the beginning of this week, against 58s 6d only a fortnight earlier. With the approach of the new capital issues, C. A. Parsons were as much as 10s to the good, and A. Reyrolle 5s better, in the course of a week. Babcocks put on 8s 9d in the same period, and gains of half-a-crown or better were shown by G.E.C., English Electric, Decca and Murex. Smaller improvements occurred fairly plentifully in the list of electrical manufacturing shares. Among them were gains of 1s or more in B.I.C.C., Ericssons, Chloride Electric, Pye and E.M.I. An active renewal of interest in Elliott Brothers took the price of the shares from 22s 6d to 27s 3d at one time, before a partial reaction to 26s 3d. Associated Insulation Products moved up in sympathy to about the same price.

Morphy-Richards Stock

Dealings are now taking place in the new Morphy-Richards 6 per cent convertible loan stock. Offered to the company's shareholders at 98½, the issue came out when markets were at their least receptive and much of it went to the underwriters. The latter could congratulate themselves for, after opening at a discount, the stock quickly advanced to about 1½ points over the issue price. Through the conversion rights, holders of the stock will have the opportunity of converting into the company's 4s ordinary shares, between the end of next year and 1960, on the basis of one share for 11s 3d stock in the first two years, and for 12s 6d stock in the second two. At present the shares are quoted at about 10s 9d. The loan stock is fully paid-up, and will be transferable free of stamp duty until the middle of next month.

Parsons and Reyrolle

Meetings are being held next Tuesday, the 18th, in connection with the issues of ordinary capital by C. A.

Price Changes in

Company or Board	Nom. Value	Middle price 10th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1956 Highest	1956 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	73½	+1	3	3	4 1 9	80½	72½
Brit. Elec. 1974/77	100	71½		3	3	4 4 0	79⅛	71½
Brit. Elec. 1976/79	100	75½		3½	3½	4 12 9	84	74½
Brit. Elec. 1974/79	100	85½		4½	4½	4 19 6	95	85½
Overseas Electric Supply								
Calcutta Elec.	£1	18/6	−6d	6†	6†	9 9 9†	20/9	18/6
East African Power	£1	19/-		7	7	7 7 3	21/3	19/-
Nigerian Elec.	£1	17/6		10	10*	11 8 6	21/-	17/-
Perak Hydro-Elec.	£1	14/-		10	10*	14 5 6	17/6	14/6
Equipment and Manufacturing								
Aberdare Cables	5/-	9/9		17½	17½	9 9 3	13/6	9/9
Aerialite	1/-	5/-	+3d	45	48	9 12 0	6/9	4/9
Allen, W. H.	£1	35/-		20	10*	5 14 3	39/-	33/6
Aron Elec. Ord.	£1	52/6		15	15	5 14 3	56/-	52/6
Assd. Automation	10/-	15/-	−3d	10	5	3 6 9	19/-	15/-
Assoc. Elec. Ord.	£1	67/6	+6/3	14	15	4 9 0	85/6	57/6
Automatic Tel. & El.	£1	52/6	+2/6	15	15	5 14 3	72/6	50/-
Babcock & Wilcox	£1	77/6	+8/9	15	15	3 17 6	85/6	64/-
Baldwin, H. J.	2/-	4/6		20	20	8 17 9	5/-	3/9
Bakelite	10/-	22/6		16	16	7 2 3	34/-	22/6
Berry's Electric	5/-	5/9	−3d	—	10‡	8 14 0	6/6	5/9
British Aluminium	£1	66/3	+4/6	12	12	3 12 6	78/9	40/6
B.I. Callender's	£1	48/-	+1/-	10	12½	5 4 3	54/3	45/-
B.I. Callender's 6% Pref. ...	£1	21/3		6	6	5 13 0	22/6	20/3
British Tabulating...	£1	41/3	+6d	9	9	4 7 3	51/3	37/3
British Thermostat	5/-	25/-		20	25	5 0 0	31/9	24/6
British Vac. Cleaner	5/-	7/9	+3d	30	15*	9 13 6	8/9	6/-
Brook Motors	10/-	30/-		25	25	8 6 9	44/-	30/-
Brush Group	5/-	4/6		10	10	11 2 3	7/9	4/6
Bulgin, A. F.	1/-	4/-		45	50	—	5/3	4/-
Burco Dean	5/-	8/3		22½	20	12 2 6	13/6	8/3
Chloride El. Storage "A" ...	£1	56/3	+1/3	17½	17½	6 4 6	73/6	55/-
Clarke Chapman	£1	120/-	+2/6	20	22½	3 15 0	123/-	89/6
Cole, E. K....	5/-	15/9	+6d	17½	17½	5 11 0	22/3	15/-
Cossor, A. C.	5/-	5/9		15	Nil	Nil	10/3	5/-
Crabtree	10/-	23/-		20	20	8 14 0	29/3	23/-
Crompton Parkinson Ord. ...	5/-	13/-		16	16	6 3 0	15/-	12/3
De La Rue	5/-	16/6	+1/-	30	30	9 1 9	20/3	15/-
Decca "A"	4/-	27/-	+3/3	56½	43¾*	6 9 9	44/9	23/3
Desoutter	5/-	29/-		25	30	5 3 6	32/9	25/9
Dewhurst	2/-	5/9	+3d	30	16½*	5 13 0	7/6	5/3
Dictograph Tel.	2/-	6/9		20	20	5 18 6	7/3	5/6
Dubilier Condenser	1/-	5/-	+3d	25	30	6 0 0	5/3	3/6
Duport	5/-	17/6		23	25	7 2 9	21/6	13/9
E.M.I.	10/-	24/3	+1/6	15	15	6 3 9	37/-	22/6
Electrical Components	5/-	7/-		25	25	8 18 6*	8/-	6/3
Elec. Construction	£1	22/6		8½	8½	7 11 0	29/9	22/6
Elliott Bros.	5/-	26/3	+3/9	17½	20‡	3 16 3	36/9	22/6
Enfield Cable Ord.	£1	13/-		Nil	Nil	Nil	19/3	13/-
English Electric	£1	47/6	+2/6	12½	12½	5 5 3	66/3	43/9
English Electric 3½% Pref. ...	£1	13/-		3½	3½	5 15 6	14/6	12/6
Ericsson Tel.	5/-	33/-	+1/-	20†	20†	3 0 6†	42/9	31/-
Ever Ready	5/-	27/9		35	35	6 6 3	32/9	24/-
Falk Stadelmann	£1	35/6		17½	17½	9 17 3	45/9	35/6
G.E.C. Ord.	£1	45/-	+2/6	12½	14	6 4 6	65/6	41/3
G.E.C. 6½% Pref.	£1	22/-		6½	6½	5 18 3	23/9	21/3
General Cables	5/-	11/3		30	30	13 6 9	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Holdings	5/-	19/3	+6d	25	30	7 15 9	24/6	18/9
Hackbridge & Hewittic	5/-	13/9		30	23*	8 7 9	22/-	13/9
Heatrae	2/-	4/-		15	15	7 10 0	5/1	3/9
Henley's	10/-	14/9	+6d	10½	11½	7 16 0	19/9	14/-
Holophane...	5/-	17/6		30	30	8 11 6	21/6	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

Parsons and A. Reyrolle. Dealings in the new shares are expected to begin shortly afterwards. Meanwhile shareholders have been given more information about the purposes of the operations, which will produce more than £5 million additional funds for each company. Part of this is needed for investment in the Nuclear Power Plant Company and the Anglo Great Lakes Corporation, the graphite manufacturing project, in the development of which both companies are associated. Money is required also to increase working capital, and to enlarge production and research facilities. Reyrolle would also need funds to subscribe for its allotment of new shares in respect of its large holding of C. A. Parsons ordinary capital.

Electrical Investments

Company or Board	Nom. Value	Middle price 10th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	23/6		70	50	10 12 9	39/3	23/-
I.C.I.	£1	37/6	−9d	10	10	5 6 9	49/9	37/3
Intl. Combustion	5/-	17/9	−1/-	25	20*	5 12 9	25/-	15/3
Johnson & Phillips	£1	27/6		15	15	10 18 3	46/6	27/6
Lancashire Dynamo	£1	37/6		15	11*	5 17 0	49/9	37/6
Laurence, Scott	5/-	14/3	−6d	12½	15	5 5 3	16/9	13/3
Lister, R. A.	£1	24/6		9·3	10	8 3 3	35/3	24/6
London Elec. Wire	£1	42/6		12½	12½	5 17 9	52/9	42/6
Lucas, J.	£1	28/9		7½	7½	5 4 3	40/3	28/9
Marryat & Scott	2/-	8/9		30	30	6 17 3	11/3	8/9
Mather & Platt	£1	50/-		15	15	6 0 0	65/3	50/-
Metal Industries	£1	22/6	+6d	9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	10/9	+3d	50	50	—	13/9	10/-
Murex	£1	65/6	+3/6	20	20	6 2 3	74/6	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/6		20	17½*	7 0 0	3/-	2/3
Parnall (Yate)	5/-	6/-		14	12	10 0 0	9/6	5/6
Parsons, C. A.	£1	98/9	+10/-	10	10	2 0 6	96/-	61/6
Plessey	10/-	61/3	+2/-	27½	30	4 18 0	87/6	56/-
Pye "A" Deferred	5/-	15/6	+1/9	12½	12½	4 0 9	21/3	13/3
Reyrolle	£1	100/-	+5/-	15	16½	3 5 0	117/6	81/-
Rheostatic	4/-	9/-		18½	12‡	5 6 9	—	8/3
Richardsons Westgarth	5/-	15/9	+1/3	16⅝	16⅝	5 5 9	17/-	13/9
Scottish Cables	4/-	15/3	+6d	27½	27½	7 4 3	17/9	14/9
Smith (England), S.	4/-	11/3	+3d	17½	17½	6 4 6	14/3	10/6
Southern Areas	£1	13/9		10	7½	10 18 3	28/9	13/9
Strand Elec.	5/-	7/9	+6d	15	15	9 13 6	8/6	6/9
Sturtevant	5/-	22/-	+9d	14·4†	15†	3 8 3†	31/3	21/3
Sun Elec.	£1	42/6		20	25	11 15 3	42/6	33/9
Switchgear & Cowans	5/-	12/9		20	25	9 16 0	17/-	12/9
Taylor Tunnicliff	5/-	11/9	+6d	15	15	6 7 9	14/-	11/3
T.C.C.	10/-	33/9		25	25	7 8 3	45/-	33/9
T.C. & M.	£1	24/-		8½	8½	7 1 9	34/-	24/-
Telephone Mfg.	5/-	6/6	+6d	10	10*	7 13 9	8/6	6/-
Thorn Elec.	5/-	15/9	+9d	15	15	4 15 3	22/6	15/-
Thornycroft	£1	34/6	+1/-	15	12½	7 5 0	49/9	33/6
Tube Investments	£1	55/-	+2/6	22½	15*‡	5 9 0	70/6	50/9
Vactric	5/-	13/-	+1/6	15	17½*	6 14 6	15/-	11/-
Veritys	5/-	8/6		12½	12½	7 7 0	10/-	6/9
Walsall Conduits	4/-	11/6	+3d	70	20*	6 19 3	13/6	10/9
Ward & Goldstone	5/-	36/3	+6d	30	35	4 16 6	39/6	29/-
Watford	2/-	6/-	+3d	25	25	8 6 9	7/6	5/6
Westinghouse	£1	67/6		18	18	5 6 9	100/-	67/6
West, Allen	5/-	11/6	+3d	15	15	6 10 6	14/6	11/3
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Portuguese	£1	20/9	−6d	8	8	7 14 3	23/6	20/3
Brit. Elec. Traction: Def. Ord. "A"	5/-	16/-		22½	22½	7 0 9	20/-	15/6
Cable & Wireless: Ord.	5/-	9/6	+3d	10	10	5 5 3	11/3	9/3
4% Loan	100	91		4	4	4 8 0	92½	88
Calcutta Trams	£1	25/-		7½†	8½†	6 15 0†	27/6	23/-
Cape Elec. Trams	£1	16/3		8	8	9 17 0	20/3	16/3
Marconi Marine	£1	31/-		10	10	6 9 0	34/-	31/-
Oriental Tel. Ord.	1/-	67/6	+1/3	16	—	—	90/-	66/3
Telephone Rentals	5/-	9/9	+3d	12½	12½	6 8 3	11/9	9/6

Vactric Interim

Vactric 5s shares were marked up by 1s 6d to 13s, on the appearance of the interim report. This contrasts favourably with many of the other half-yearly company statements which have been appearing lately. Having paid a single ordinary dividend of 17½ per cent for the year ended last March, the company now declares on account of the current period an interim distribution of 10 per cent, on the strength of which the market thinks it fair to entertain hopes of a larger total. This view is substantiated by the very conservative character of last year's dividend, and by the company's announcement of a net group profit for the latest half-year of £275,000 (before tax), which is rather more than half the total for the preceding twelve months.

Siemens–A.E.I.

Terms of an offer from A.E.I. to holders of Siemens Brothers 4 per cent second preference shares are regarded in the market as likely to be welcomed by the latter. These preference shares are due to be redeemed at 22s per share at the beginning of January. Holders are given alternatively the chance of making an exchange on the basis of 94 "B" 4½ per cent preference shares and 16 ordinary shares in A.E.I. for every £100 of the Siemens stock. Taking prices of 15s for the A.E.I. preference and 67s 6d for the ordinary (which have appreciated considerably since the time of the proposal) the exchange would produce a joint holding worth at present about £124. Next January's repayment would amount to £110 per £100 Siemens stock. Income from the new holdings, assuming maintenance of the 15 per cent dividend, would be over £6 10s per cent.

Plessey Accounts

In his review accompanying the Plessey Company's full report, Mr. A. G. Clark, the chairman, draws attention to the strengthening of the financial resources since the issue of ordinary shares in the early part of this year. He regards the company as well placed to finance the further broadening of the bases on which the group operates. Turnover during the year ended last June was higher than in the previous twelve months but, as already known from the preliminary statement of results, the trading profit came out slightly lower at £1½ million, having been affected by the credit squeeze and by increases in working costs. Plessey 10s shares are a volatile market, with a place among the most popular "growth" stocks in the electrical group. At 61s 3d, they offer a yield of a little under 5 per cent from the conservative 30 per cent dividend.

REPORTS and DIVIDENDS

Burco Dean, Ltd., reports that after providing £162,958 for taxation, the group net profit is £127,166 for the year to 30th September last, as compared with £221,771 for the preceding period, 29th March to 30th September, 1955. The group results for 1954-55 relate to Burco Dean six months, Burco, Ltd., and all of its subsidiaries twelve months, Dean, Ltd., and two of its subsidiaries 13½ months and its other subsidiary 7½ months. It is proposed to pay a final ordinary dividend of 15 per cent, making 20 per cent for the year (against 22½ per cent for the previous period).

Broadcast Relay Service, Ltd.—An issue of £1,150,000 6 per cent debenture stock, 1976-81, has been placed privately at 97½ per cent. The new issue will rank *pari passu* as to security with the existing £1,808,653 5½ per cent debenture stock, 1965-78. The net proceeds will be applied in repayment of the £96,698 of 3½ per cent debenture stock and in repaying bank borrowing incurred in providing further finance for the company's interest in commercial television and further working capital for Redifon, Ltd., the principal manufacturing subsidiary.

Brown Brothers, Ltd., have acquired the share capital of the Needham Engineering Co., Ltd., Sheffield, wholesalers in the motor, machinery, radio and electrical trades. That company will continue to trade in its present name and with the same staff.

Turner & Newall, Ltd.—The consolidated trading profit for the year ended 30th September last amounts to £13,343,819, as compared with £12,494,817 for the preceding year, and after deducting £7,467,019 for taxation, the net balance is £5,876,800 (against £5,753,879), to which is added unrequired tax provisions of £503,895. The amount dealt with in the accounts of the parent company is £4,440,617. Of this, general reserve receives £2,250,000. It is proposed to pay a final ordinary dividend of 22½ per cent (against 20 per cent), making 27½ per cent (25 per cent) for the year. The balance carried forward is £2,348,095 (against £2,166,243 brought in).

Tube Investments Acquisition.—Formalities have been completed for the purchase by Tube Investments, Ltd., of the whole of the share capital of Bennett Tools, Ltd., Redditch, high precision engineers. Mr. R. Bennett, the founder of the business, will continue as its managing director. Mr. E. L. Burton and Mr. R. D. Young, of Tube Investments, have joined the board.

Morphy-Richards, Ltd., announce that applications from ordinary stockholders for the £500,000 6 per cent convertible unsecured loan stock, 1967-72 issued at 98½ per cent totalled £121,486 stock. The balance of the stock has been allotted to the underwriters.

Hick, Hargreaves & Co., Ltd., have declared an interim dividend of 5 per cent (unchanged) on increased capital.

Scottish Cables, Ltd., is maintaining its interim dividend at 7½ per cent.

The Lisbon Electric Tramways, Ltd., is paying an interim dividend of 2½ per cent, tax free (unchanged).

Johnson Matthey & Co., Ltd., are paying an interim dividend of 3 per cent (unchanged).

Veritys, Ltd.—As acceptances were received from stockholders holding only 36 per cent of the issued stock of the company, the offer by Limit Engineering Group, Ltd., has been withdrawn.

New Companies

Telcon Enterprises Overseas, Ltd.—Registered 27th November. Capital £100. To review, co-ordinate and supervise the activities and affairs of all or any companies with which the company is from time to time associated, and in particular companies which are subsidiaries or sub-subsidiaries, of or associated with the Telegraph Construction & Maintenance Co., Ltd., etc. Directors: J. N. Dean, C. L. G. Fairfield, L. J. Ransom and J. C. Rochester. Solicitors: Bircham and Co., 100, Old Broad Street, London, E.C.2.

R. Sawford & Co., Ltd.—Registered 27th September. Capital £100. Electrical engineers and contractors, etc. Directors: Irene M. E. Massick and R. E. H. Turner. Regd. office: Circle House, 65-71, Wembley Hill Road, Wembley, Mdx.

Sypha Sound Sales, Ltd.—Registered 16th October. Capital £100. Wholesale and retail dealers in radio apparatus, cabinets, loudspeakers, etc. Directors: Jean Shalet, Lila Leighton and P. Lubin. Regd. office: 255, High Road, N.15.

Modern Technical Services, Ltd.—Registered 16th October. Capital £100. Manufacturers of and dealers in television, radio and telephone apparatus, sets, etc. Directors: T. P. K. Yates-Round, D. J. S. Gregory and L. W. Gregory. Regd. office: Lloyds Bank Chambers, Terminus Road, Eastbourne.

David Davis, Ltd.—Registered 16th October. Capital £1,000. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. H. Davis signs as director. Regd. office: 28, High Street, Bridgwater, Som.

Quality Radio, Ltd.—Registered 16th October. Capital £1,500. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: R. G. Baxter and Mrs. Eileen M. Baxter. Regd. office: 14, Magdalen Street, Exeter, Devon.

R. M. Wilson and Company (Coventry), Ltd.—Registered 23rd October. Capital £1,000. Electrical engineers and general electrical installation contractors, etc. Directors: R. M. Wilson and B. G. Branderick. Regd. office: Haven Lodge, Binley Road, Binley, near Coventry.

Earl & Savinson, Ltd.—Registered 10th October. Capital £100. Electrical, radio, television and refrigeration engineers and contractors, etc. Directors: Hilary F. Earl and P. A. Savinson. Regd. office: 40, Mortimer Street, London, W.1.

T. W. Brightwell (Sales), Ltd.—Registered 29th October. Capital £100. Manufacturers and repairers of and dealers in dynamos, motors, armatures, etc. Directors: T. W. Brightwell and Doris M. Brightwell. Regd. office: 135, Hersham Road, Walton-on-Thames, Surrey.

G. E. Miles (Electrical Engineers), Ltd.—Registered in Edinburgh 4th October. Capital £3,000. To acquire the business of George E. Miles, electrical and radio engineer, etc. Directors: G. E. Miles and Mrs. M. W. Miles. Regd. office: 4, Beresford Terrace, Ayr.

G. W. Hands & Co., Ltd.—Registered 23rd October. Capital £10,000. Manufacturers of and dealers in radio, television and telephone apparatus, sets, etc. Directors: G. W. Hands, Mrs. Jessie K. Hands and J. G. Wilby. Regd. office: 77, Crouch Street, Colchester.

Ruhstrat (Great Britain), Ltd.—Registered 2nd November. Capital £2,000. Manufacturers of and dealers in electrical and other furnaces, etc. Directors: R. H. Spiers and A. R. Wade. Regd. office: North Lane, Aldershot, Hants.

Liquidation

Redco Electrical Co., Ltd.—Meetings of members and creditors on 4th January at Bedford Row House, 58, Theobald's Road, London, W.C.1, to receive an account of the winding up by the liquidator, Mr. R. Langdon Davis.

Bankruptcy

G. Wilson, 28, Holmwood Drive, Leicester, formerly carrying on business at 1, Abney Street, Leicester, electrical engineer.—Last day for receiving proofs for dividend 18th December. Trustee, Mr. E. C. Simpson, 27, Regent Street, Park Row, Nottingham.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 21st December:—

SGE (design). No. 741,448. Class 9. Electric and electronic signalling and movement controlling instruments and apparatus for use in directing traffic on rail, road, air and sea, and parts.—Siemens & General Electric Railway Signal Co., Ltd., East Lane, North Wembley, Middx.

CANNON. No. 746,247. Class 9. Electric connections.—Cannon Electric (Great Britain), Ltd., 138, Wardour Street, London, W.1.

RECTIFEX. No. 752,960. Class 9. Electrical apparatus and instruments and parts.—Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough, Leics.

DOT. No. B753,440. Class 9. Electrical apparatus and instruments and parts; and electric plugs, sockets, switches and connectors.—Carr Fastener Co., Ltd., Pinfold Lane, Stapleford, Nottingham.

PRINCESS. No. 754,680. Class 9. Electric vacuum cleaning apparatus and parts.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

TELMAG. No. 755,463 and No. 755,464 (design). Class 9. Magnetic cores for electrical apparatus.—Telcon-Magnetic Cores, Ltd., Block No. 4, Industrial Estate, Chapelhall, Airdrie, Lanarkshire.

STABILAC. No. 755,630. Class 9. Automatic voltage regulators and voltage stabilisers.—Claude Lyons, Ltd., 76, Old Hall Street, Liverpool, 3.

SIMPLOMATIC. No. 757,031. Class 9. Electrical apparatus and instruments and parts. SIMPLOMATIC. No. 757,032, Class 11. Apparatus for cooking, heating, lighting, refrigerating, drying and ventilating, and parts.—Revo Electric Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs.

MINI MAID. No. 757,469. Class 9. Electric suction cleaners and domestic electric floor polishing machines and parts.—Vacuum Cleaner Supplies, Ltd., 20-22, Gipsy Hill, London, S.E.19.

No. 753,271 (design). Class 11. Electric lamps.—British Luma Co-operative Electric Lamp Society, Ltd., 95, Morrison Street, Glasgow, C.5.

"House of the Future"

New and impending developments in electrical equipment for the home are being shown to the public for the first time in "Electrovilla—the House of the Future" which opened in the basement of the North Western Electricity Board's central service centre, Manchester, on 3rd December.

With the co-operation of a number of manufacturers, the Board's research department has planned the house, which is circular in shape, to show the potentialities of high frequency, electronics, and television in bringing automation into the kitchen. Some appliances are already available; others are in use in America and are at the development stage in this country.

Both the kitchen (or cookery) and the lounge (or snuggery) are fitted with batteries of four and six three-pin points for the convenient connection of electrical appliances. In the kitchen is the service cupboard where the electricity meter is readily accessible. Automatic trips are provided for the speedy restoration of supply.

Other outstanding features of "Electrovilla" are the "Advisophone," incorporating microphone, recording device and amplifier so that callers can leave verbal messages when the householder is out; and all-channel television, for receiving television programmes, closed circuit television for keeping a watch on the children in the nursery or garden, and a recipe viewer whereby at the touch of a button the wanted recipe appears on the screen.

Cold, tepid, warm, hot or very hot water can be fed into the sink from under the cowling, instead of by tap, at the touch of the appropriate button. There is also a built-in automatic washing machine and hydro extractor. In an electronic oven food is cooked by high frequency micro waves, instead of by heat which would be required only for dishes needing browning, infra-red grill and super speed boiling plates. A self-heated mobile trolley for keeping food hot can also be used as a table.

The kitchen is fitted with built-in cupboards, with lighting automatically controlled as the doors are opened or shut. Heating throughout is provided by the floor warming system which is fast finding favour in the Manchester area in new bungalows, offices and laboratories.

Following an indefinite run in Manchester, "Electrovilla" is to appear at the major showrooms throughout the Board's area during the next two years.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged.

Monday, 17th December

IPSWICH. — Electric House, 7.15 p.m. Ipswich & District Electrical Association. Film show.

LONDON.—Northampton Polytechnic, St. John Street, E.C.1, 5.30 p.m. Institute of Metal Finishing. Annual general meeting.

Tuesday, 18th December

BELFAST. — Overseas House, Wellington Place, 6.30 p.m. I.E.E. Northern Ireland Graduate & Student Section. "Basic Factors in Contactor Design," by L. Watson.

BIRMINGHAM.—At the Midland Institute, Paradise Street, 7 p.m. Institution of Works Managers, Birmingham Branch. "The Application of Radio-isotopes in Industry," by Dr. J. Golden.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "A Description of a Medium-Sized Industrial Electrical Distribution System with particular Reference to Efforts made to Reduce Energy Costs," by R. W. Robinson.

LIVERPOOL.—24, Hatton Garden, 6 p.m. I.E.S. Liverpool Centre. Members' night. "Interesting Lighting Installations," papers by Centre members.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement & Control Section. Discussion on "Breakdown in Dielectrics," opened by C. G. Garton and J. H. Mason.

2, Savoy Hill, W.C.2, 6.30 p.m. Association of Supervising Electrical Engineers. London National Lecture: "In Search of Coal, with particular reference to undersea Reserves," by W. H. Brooks.

Wednesday, 19th December

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Choice of Insulation and Surge Protection of Overhead Transmission Lines of 33 kV and Above," by A. Morris Thomas and D. F. Oakeshott.

MANCHESTER. — Engineers' Club, Albert Square, 2.30 p.m. Institute of Fuel, North-Western Section. "My Recent Visit to the U.S.S.R.," by A. R. Cooper.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institution, Corporation Road, 6.30 p.m. I.E.S. Tees-Side Group. "How to Live with Light," by R. J. Fothergill.

NEWCASTLE-UPON-TYNE. — King's College, Stephenson Building, 7 p.m. Society of Instrument Technology, Newcastle Section. "Instrumentation of Nuclear Reactors," by T. R. Thompson.

NOTTINGHAM. — E.M.E.B. Showroom Theatre, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. American industrial films' evening.

PRESTON.—N.W.E.B., 19, Friargate, 7.15 p.m. I.E.S. North Lancashire Group. "School Lighting, Part 2," by F. Ainscow and J. M. McEwing.

ROCHESTER.—Kings Head Hotel, 7 p.m. Incorporated Plant Engineers, Kent Branch. "Plant Planning and Development," by A. W. Western.

Thursday, 20th December

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Electrical Installations in Lighthouses and Lightships," by N. D. Clotworthy.

MAIDSTONE.—Queen's Head Hotel, 8 p.m. A.S.E.E. Kent Branch. Social evening.

MANCHESTER. — N.W.E.B., Town Hall, 6 p.m. I.E.S. Manchester Centre. "Colour Matching," by A. Wilcock.

Friday, 21st December

LONDON.—Caxton Hall, S.W.1, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Group. "A Thousand Instruments," by W. A. Seatherton.

Left: General view of the exterior of the lounge in the display house, "Electrovilla," in the North Western Electricity Board's central service centre, Manchester. Right: Part of the kitchen showing (left to right) infra-red grill, electronic oven, launderette with washing machine and hydro extractor, work table with built-in washing machine below and refrigerator with separate deep freeze compartment

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 19th December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1952

11249. Tyszkiewicz, S. E.—Electrical control mechanism. 1st May, 1953. (763724.)

1953

4168. General Electric Co., Ltd., Corke, A. G., and Shaw, H. J. H.—Electro-acoustic transducers. 2nd February, 1954. (763727.)

9420. Permutit Co., Ltd.—Electrolytic processes. 25th March, 1954. (764067.)

12323. British Thomson-Houston Co., Ltd.—Winding equipment. 30th April, 1954. (763968.)

14480. Standard Telephones & Cables, Ltd.—Subscriber billing in automatic telecommunication exchange systems and the like. 26th April, 1954. (763828.) 18491. Line identification in telecommunication systems. 25th June, 1954. (763829.)

24688. Cinema-Television, Ltd.—Electron gun structures. 7th September, 1954. (763951.)

25225. British Telecommunications Research, Ltd.—Electric carrier telegraph systems. 7th September, 1954. (763732.)

26725. Cinema-Television, Ltd.—Methods of manufacturing electron discharge devices. 29th September, 1954. (763952.)

28358. VEB Funkwerk Köpenick.—Electro-acoustic transducer of the moving coil type. 14th October, 1953. (763974.)

30544. Raytheon Manufacturing Co.—Electric signal circuits and echo-ranging systems employing such circuits. 4th November, 1953. (764184.)

33618. Standard Telephones & Cables, Ltd.—Electrical circuits employing transistors. 26th November, 1954. (763734.)

35209. National Research Development Corporation.—Electronic circuits embodying transistors. 16th December, 1954. (763735.)

1954

889. Mullard Radio Valve Co., Ltd.—Flash tubes. 12th January, 1954. (763979.)

2007. Permutit Co., Ltd.—Electrolytic processes. 22nd January, 1954. (764068.)

10200. English Electric Co., Ltd.—Manufacture of integrated mica. 1st April, 1955. (763849.)

10239. British Thomson-Houston Co., Ltd.—Electronic frequency selective circuit arrangements. 20th April, 1955. (763850.)

10947. Standard Telephones & Cables, Ltd.—Manufacture of thermionic valves. 14th April, 1954. (763988.)

10964. Peugeot & Cie.—Kitchen multi-purpose electrical apparatus. 14th April, 1954. (763989.)

11162. Kelvin & Hughes, Ltd.—Projector lamps. 14th April, 1955. (763739.)

11970. Standard Telephones & Cables, Ltd.—Storage of intelligence in electrical form. 26th April, 1954. (763830.)

13376. American Air Filter Co., Inc.—Electrostatic filters. 7th May, 1954. (764080.)

13712. Standard Telephones & Cables, Ltd.—Manufacture of electrical capacitors. 6th May, 1955. (763740.)

14602. Pyror, Ltd.—Electrolytic cells. 18th May, 1954. (764191.)

17287. Standard Telephones & Cables, Ltd.—Method of making a photo-conductive sheet for a radiation amplifier. 11th June, 1954. (763744.)

17418. Philips Electrical Industries, Ltd.—Camera tubes with photo-conductive image electrodes. 14th June, 1954. (763745.)

21769. I-T-E Circuit Breaker Co.—Electric circuit-breaker operating mechanism. 26th July, 1954. (763747.)

23143. Telefonaktiebolaget L. M. Ericsson.—Apparatus for indicating abnormal functioning of one (or more) electrical devices. 9th August, 1954. (764096.) 23841. Electron tubes for generating high frequency oscillations. 16th August, 1954. (763862.)

24777. Sperry Gyroscope Co., Ltd.—Snap-action electric switches. 20th May, 1955. (763863.)

24951. Standard Telephones & Cables, Ltd.—Synchronous oscillator arrangements. 27th August, 1954. (764008.)

26897/8. Allis-Chalmers Manufacturing Co.—Electric circuit interrupters having sickle-shaped contact members. 16th September, 1954. (764073/4.) 26899. Electric switching arrangement for use in a liquid-blast circuit interrupter. 16th September, 1954. (764075.)

28743. Automatic Telephone & Electric Co., Ltd.—Relaxation oscillators. 6th October, 1954. (763866.)

28789. Mullard Radio Valve Co., Ltd.—Electric pulse forming circuit arrangements employing transistors. 24th May, 1955. (763749.)

29758. Western Electric Co., Inc.—Travelling wave tubes. 15th October, 1954. (764012.)

36072. Technograph Printed Circuits, Ltd.—Capacitors. 13th December, 1954. (764017.)

36286. International Business Machines Corporation.—Switching circuits employing junction transistors. 15th December, 1954. (764100.)

36909. Mullard Radio Valve Co., Ltd.—Cold cathode electric discharge tubes. 21st December, 1954. (763959.) 36910. Circuit arrangements for electric discharge tubes. 21st December, 1954. (763960.)

1955

292. Compagnie Générale d'Electricité.—Electric cable comprising a screening device and method for manufacturing same. 5th January, 1955. (764026.)

524. Collier, R.—Thermally-responsive electric heat regulating switch. 7th January, 1955. (763892.)

545. Standard Telephones & Cables, Ltd.—Radio frequency transmission system. 7th January, 1955. (763894.)

550. Philips Electrical Industries, Ltd.—Magnetic recording and reproducing devices. 7th January, 1955. (764109.)

557. Licentia Patent-Verwaltungs-Ges.—Inverting circuit with frequency stabilisation. 7th January, 1955. (763897.)

801. Hoover, Ltd.—Suction cleaners. 11th January, 1955. (764208.)

828. Soc. Erec Soc. d'Etudes, de Réalisations et d'Exploitations Commerciales.—Liquid feeder or distributor for priming electric batteries and other applications. 11th January, 1955. (764113.)

869, 2494 and 2653. Philips Electrical Industries, Ltd.—Methods of manufacturing non-metallic magnetic cores having a substantially rectangular hysteresis loop. 11th, 27th and 28th January, 1955. (764118/763809/763818.)

978. Elmeg Elektro-Mechanik Ges.—Electro-magnetic step-by-step mechanism for use in meter and printing mechanism. 12th January, 1955. (763905.)

1214. Licentia Patent-Verwaltungs-Ges.—Arrangement for stabilising the voltage of a synchronous generator. 14th January, 1955. (Addition to 745770.) (764035.) 1215. Multi-casing steam turbine set for very high pressures and temperatures. 14th January, 1955. (764134.)

1255. Standard Telephones & Cables, Ltd.—Coaxial electric cables and methods of making same. 14th January, 1955. (763761.)

1518. Philips Electrical Industries, Ltd.—Electric apparatus comprising one or more electronic devices. 18th January, 1955. (764140.)

1559. Standard Telephones & Cables, Ltd.—Frequency control arrangements for frequency shift telegraph systems. 18th January, 1955. (763773.)

1572. Siemens-Schuckertwerke Akt.-Ges.—High power electric generator sets. 18th January, 1955. (764046.)

1798 and 1800/1/3. General Electric Co.—Electric flat irons. 21st January, 1954. (763786/88/89/90.)

1799. General Electric Co.—Electric steam irons. 21st January, 1954. (763787.)

1819. Borresen, J., and Pettersen, G. N.—Mounting strip for the detachable mounting of flexible electric installation cables. 20th January, 1955. (763791.)

1908. Standard Machinery Co.—Telescopic splice-boxes for use in apparatus for vulcanising extrusion-coated cable and wire insulation. 21st January, 1955. (764222.)

1921. General Electric Co.—Radiographic diaphragm and method of making same. 21st January, 1955. (764224.)

2098. Ray-O-Vac Co.—Electric primary cells. 24th January, 1955. (764049.)

2179. Air-Maze Corporation.—Electrostatic precipitator. 25th January, 1955. (764237.)

2219. General Electric Co.—Electro-magnetic apparatus. 25th January, 1955. (764050.) 2220. Electrical lead-in structure. 25th January, 1955. (764241.)

2222. Metropolitan-Vickers Electrical Co., Ltd. (Compagnie Française Thomson-Houston).—Radar aerial assemblies. 25th January, 1955. (763805.)

2249. Sulzer Freres Soc. Anon.—Steam power plants. 25th January, 1955. (763919.)

2286. National Cash Register Co.—Apparatus for controlling the direction of rotation of the armature of a dynamo-electric machine. 26th January, 1955. (764243.)

2291/2. Hoover, Ltd.—Food mixers. 26th January, 1955. (763806 and 763920.)

2350. Creed & Co., Ltd.—Printing telegraph transmitters. 26th January, 1955. (764244.)

2356. International Business Machines Corporation.—Magnetic transducer unit. 26th January, 1955. (764245.)

2389. Rohatyn, F. S.—Cooling arrangements for stationary electrical apparatus. 26th January, 1955. (763925.)

2654. Philips Electrical Industries, Ltd.—Transistor amplifiers. 28th January, 1955. (763819.) 2840. Control of the amplification factor of a transistor. 31st January, 1955. (764260.)

2670. Standard Telephones & Cables, Ltd.—Point contact semi-conductor translating devices. 28th January, 1955. (763927.)

2713. Siemens & Halske Akt.-Ges.—Multi-core carrier frequency telecommunication cables. 28th January, 1955. (764056.) 2714. Teleprinters. 28th January, 1955. (764057.)

2883. Inreco Aktiebolag.—Electro-magnetic mercury relay of the impulse type. 31st January, 1955. (764261.)

2924. Standard Telephones & Cables, Ltd.—Electron-discharge apparatus. 1st February, 1955. (764263.)

2994. General Electric Co.—Electronic gating circuits. 1st February, 1955. (764267.)

3066. Westinghouse Electric International Co.—Arc extinguishing devices in or for electric switch apparatus. 2nd February, 1955. (764271.)

3080. Western Electric Co., Inc.—Power supply circuits for electron-discharge devices. 2nd February, 1955. (764273.)

[*Continued on page* 1123

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Blackpool.—Borough Council. 18th January. Electric lamps for the year ending 31st March, 1958. (See this issue.)

Ilford.—Borough Council. 7th January. Lamps for one year from 1st April, 1957. Borough surveyor, Town Hall.

India.—Madhya Pradesh Electricity Board. 20th December. Four forced draught cooling tower fans and accessories for Khaperkheda power station. (E.S.B. 30102/56. Ten/22966)*

Director General of Supplies and Disposals. 21st December. 1,072 salammoniac cells. (E.S.B. 30400/56. Ten/23003.)* 27th December. Two electrically driven pumping sets. (E.S.B. 30399/56. Ten/23004.)*

Saurashtra Electricity Board. 24th December. V.i.r. cables. (E.S.B. 30381/56. Ten/23026.)*

Government of Madras. 31st December. 36 kW electric muffle furnace, 50 kW bath furnace and 22 kW convection furnace, etc. (E.S.B. 30128/56. Ten/22995.)*

Madras Port Trust. 10th January. Two battery operated fork-lift trucks. (E.S.B. 30682/56. Ten/23100.)*

Ipswich.—Borough Council. 7th January. Street lighting equipment. Borough engineer, 19, Power Street.

Iraq.—Directorate-General of Municipalities, Baghdad. 5th January. Electrical materials including stay plates, rods and swivels, aerial fuses and iron clad switches, etc. (E.S.B. 30326/56. Ten/23040.)* Street lighting equipment including time switches, lanterns and brackets. (E.S.B. 30327/56. Ten/23041.)* Electrical materials. (E.S.B. 30328-9/56. Ten/23042-3 and E.S.B. 30325/56. Ten/23044.)*

Ministry of Interior. 5th January. Two 100 kW and one 50 kW generating sets. (E.S.B. 30320/56. Ten/23038.)*

Italy.—Ministero della Difesa-Aeronautica. 20th December. 500,000 metres of telephone cable. (E.S.B. 30651/56. Ten/23049.)*

Kettering.—Borough Council. 19th January. Street lighting equipment. (See this issue.)

Manchester.—City Council. 2nd January. Paper insulated armoured cable for the Airport. (See this issue.) 28th February. Seven 900 kW dual-fuel engine alternator sets and auxiliary plant for Davyhulme sewage works. (See this issue.)

New Zealand.—Taupo Borough Council. 16th January. Electrically operated pumping sets. (E.S.B. 30492/56. Ten/23046.)*

General Post Office. 17th January. Four 5 kW radio transmitters. (E.S.B. 30336/56. Ten/23050.)* 28th January. Diesel-electric alternator sets. (E.S.B. 30688/56. Ten/23094.)* 25th January. 2,600 fuse mountings. (E.S.B. 30020/56. Ten/22947.)*

Philippines.—National Power Corporation. 16th January. 50,000 kVA transformer. (E.S.B. 30476/56. Ten/23058.)*

Rhodesia and Nyasaland.—Ministry of Posts. 4th January. 60,000 telephone dry cells. (E.S.B. 30536/56. Ten/23066.)*

Office of the Controller of Stores and Transport. 4th January. Telephone wire. (E.S.B. 30534/56. Ten/23055.)*

Rochdale.—Borough Council. 5th January. Electrical installation in St. Peter's C.E. School. (See this issue.)

St. Helens.—Borough Council. 29th December. Street lighting equipment. (See this issue.)

South Africa.—City of Johannesburg. 27th December. 280 traffic signal head assemblies with lamps. (E.S.B. 30057/56. Ten/22985.)*

Stores Department, South African Railways. 2nd January. 33,000ft of conduit and 100ft of tubing. (E.S.B. 30463/56. Ten/23053.)* Cable. (E.S.B. 30464/56. Ten/23033.)*

Stamford—Borough Council. 1st January. Installation of electric water heaters in 512 houses. (See this issue.)

Uruguay.—Administracion de las Obras Sanitarias del Estado. 18th February. Electric pumps and accessories. (E.S.B. 30421/56. Ten/23076.)*

Watford.—Borough Council. 21st December. Street lighting equipment. (See this issue.)

Worksop.—Borough Council. 14th January. Street lighting equipment. (See this issue.)

* **Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).**

ORDERS PLACED

Oxford.—Regional Hospital Board. Electrical services in connection with the reorganisation of the engineering services and laundry at the Amersham General Hospital (£5,386).—Wm. Steward. Electrical work for the new admission unit of St. John's Hospital, Stone (£15,512).—B. French. Electrical work at a new boiler house and plant at St. Crispin Hospital, Duston (£3,208).—Blackburn Starling & Co.

Reading.—Thames Conservancy Special Committee. Accepted. Electric lighting fittings for the new offices and workshops (£1,020).—Falk, Stadelmann & Co.

Yeovil. — Corporation. Recommended. Street lighting installation on the Sunningdale estate (£1,389).—Revo Electric Co.

NEW PATENTS (*continued from page* 1122)

3244. Soc. Anon. de Télécommunications.—Symmetrical electric conductor pairs for high frequency telecommunication cables. 3rd February, 1955. (764287.)

3401. Philips Electrical Industries, Ltd.—Beam splitters for separating light from a light source into a plurality of colour components. 4th February, 1955. (764144.)

4154. Philips Electrical Industries, Ltd.—Transistor push-pull amplifiers. 11th February, 1955. (764154.)

4530. Patent-Treuhand-Ges. für Elektrische Glühlampen.—Wire electrode for electric vapour- and/or gaseous-discharge lamps. 15th February, 1955. (764160.)

4620. Westinghouse Electric International Co.—Electrically heated steam irons. 16th February, 1955. (764161.)

5073. Compagnie Electro-Mecanique.—Electric circuit control means including quick action switches. 21st February, 1955. (764165.)

5378. Westinghouse Electric International Co.—Machines for washing fabrics. 23rd February, 1955. (764169.)

5609. Conducteur Electrique Blinde Incombustible.—Automatic device for connecting an a.c. generator in phase with a live network. 24th February, 1955. (764173.)

5649. Allmanna Svenska Elektriska Aktiebolaget.—Control systems for electric motors. 25th February, 1955. (764174.)

5695. Standard Telephones & Cables, Ltd.—Safeguarding arrangement for electric communication systems. 25th February, 1955. (764175.)

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alfreton.—Large group of shops as redevelopment of central area; U.D.C. surveyor, Cornhill House, Alfreton, Derbys.

Ashington.—Houses (194), shops (3), rest centre, etc., on site south of Mining School; surveyor, Urban Council Offices.

New departments at Ashington Hospital (£90,000); K. Bowey & Son, Great North Road, Newcastle.

Barnard Castle.—Additions to Barnard Castle School (£30,000); W. B. Edwards & Partners, architects, Claremont Buildings, Newcastle-on-Tyne.

Billingham.—Flats (92) at Marsh House Avenue and houses (79) in Roseberry Road; U.D.C. surveyor.

Blaydon.—Houses (50) at Wruldton; U.D.C. surveyor.

Carlisle.—Proposed school for educationally subnormal children; L. J. A. Stow, city engineer, 18, Fisher Street.

Corby.—Shops, maisonnettes, flats and offices, Corporation Street; Corby Development Corporation architect, Corby, Northants.

Crosby.—Houses, Brownmoor estate (200) and Elm Road, Seaforth (20); J. R. Fothergill, borough surveyor, Town Hall, Waterloo, Liverpool, 22.

Croydon.—Assembly hall, gymnasium, cloakrooms and enlarged science laboratory at Croham Hurst School; governors, 79, Croham Road, South Croydon.

Dagenham.—Offices; May & Baker, Ltd., Rainham Road South.

Dawley.—Houses (200) in connection with Birmingham overspill; surveyor, Urban Council Offices, Dawley, Salop.

Doncaster.—Curlew Junior School in Barnby Dun Road; borough architect.

Houses (34) for teachers; R.D.C. architect, Doncaster.

Dudley.—Three blocks of eight-storey flats, Old Park Farm estate; borough architect.

Dundee.—Bus depot, and first phase of new headquarters at Marchbanks, for Cleansing Committee; city architect, 17, City Square.

Edgware.—Old people's home, Stonegrove; C. G. Stillman, Middlesex county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Edmonton.—Factory, Langhedge Lane; Alfred Knifton, Ltd., 117b, Fore Street.

Grangemouth.—Houses (116) on the Airfield site; Scottish Special Housing Association, Ltd., 15-21, Palmerston Place, Edinburgh.

Guildford.—Houses (98), Park Barn estate; borough surveyor.

Hebburn.—Houses (215); H. C. Bestow, U.D.C. surveyor.

Hull.—Office block; Joseph Rank, Ltd., Clarence Street.

Workshops and offices, Francis Street; L. Sterne & Co., Ltd., 199, Anlaby Road.

Hyde.—Houses (44), off Lodge Lane; Dean & Whipp, Ltd., builders, Clarendon Road.

Keighley.—Flats (90), Braithwaite estate; borough architect.

London.—Hall and offices, Gresham Street, City; Wax Chandlers Company, 14, Southampton Place, W.C.1.

Secondary school, Norbury; Gee, Walker & Slater, Ltd., builders, 100 Park Lane, W.1.

Dwellings (136), Wenlock Barn estate and Windsor Terrace, Shoreditch; Walter Law-

rence & Son, Ltd., builders, 31, Sun Street, E.C.2.

Factory, High Road, Tottenham; Cannon Rubber Manufacturers, Ltd., Ashley Road, N.17.

New buildings for London School of Printing and Graphic Arts, Elephant & Castle site, Southwark; Dr. J. L. Martin, Architects' Department, County Hall, Westminster Bridge, S.E.1.

Maidenhead.—First phase of girls' grammar school (£142,631); Berks county architect, Wilton House, Parkside Road, Reading.

Middlesbrough.—New police headquarters; J. A. Kenyon, borough engineer.

Newcastle-on-Tyne.—Extensions to the Percy Hedley School for Spastic Children (£60,000); C. S. Errington, 46, Grainger Street.

Secondary technical boys' school, Stamfordham Road; H. V. Lightfoot, director of education, Education Office, Northumberland Road.

North Shields.—Storage terminal, Northumberland Dock (£1,000,000); Esso Petroleum Co., Ltd., 36, Queen Anne's Gate, London, S.W.1.

Redcar.—Day special school; North Riding county architect, County Hall, Northallerton.

Richmond (Yorks).—Proposed modern school for North Riding E.C. (£207,000); F. Shepherd & Sons, builders, York.

Rugby.—Flats (56), Bromwich Road; Browning Construction Co., Ltd., 19, Hillmorton Road.

Salford.—Public health offices (£155,000), Crescent civic centre; city engineer, Town Hall, 3.

Seaham.—Houses (150) at Northlea and Milldale; A. M. Smith, U.D.C. surveyor.

Sheffield.—Multi-storey car park, Meetinghouse Lane/Bank Street site (£500,000); J. L. Womersley, city architect, Town Hall, 1.

Slough.—New general hospital; North West Metropolitan Regional Hospital, Sheffield House, Sheffield Street, London, W.C.2.

South Shields.—Infants' schools at Highfield Road and Whiteleas Street; John Reid, borough engineer.

Southend-on-Sea.—Municipal office block (£50,000); borough architect, 30, Alexandra Street.

Stockton-on-Tees.—Works, Dog Hill Farm industrial estate; Stockton Metal Works, Ltd., Norton Road.

Sunderland.—Methodist church, Red House estate (£18,000); S. Pace, builder, Kings Road.

Thornaby.—Houses (125), Manfield Farm and (50) near village green; borough engineer.

Twickenham.—Flats and maisonnettes (42), Little Queen's Road, Teddington; borough surveyor.

Tynemouth.—Fire station and ambulance depot; borough engineer, 16, Northumberland Square, North Shields.

Proposed Broadway Secondary Modern School; Tasker & Partner, architects, 25, New Bridge Street, Newcastle-on-Tyne.

Wallasey.—Claremont Special School; Ernest Griffiths & Sons, electrical consultants, Kinders, Allport Road, Bromborough.

Eleven-storey block of flats, Church Street; borough architect.

Wallingford.—Secondary modern school; J. M. Jones & Sons, Ltd., builders, Highway Works, Maidenhead.

Welshpool.—Factory, Henfaes Lane; Wolsey, Ltd., hosiery manufacturers, King Street, Leicester.

Westerham.—Extensions including lift installation at Valence Boarding Special School (£24,500); S. H. Loweth, Kent county architect, Springfield, Maidstone.

Windsor.—Flats (40), Clewer New Town; borough engineer.

CANADIAN ELECTRICAL IMPORTS

IN Canada's imports of electrical apparatus last year, valued at a total of $226·7 million, there was an increase of about 10 per cent on 1954. Group aggregate values for 1955 are tabulated below with notes of increases or decreases on the preceding year. The principal advances were in motors over $10 in value, steam generating plant, meters and radio goods. The only noteworthy decrease was in telegraph material. The United States maintained its customary predominant position in the trade generally. The share of the United Kingdom fell off in many lines but in her steam generating plant there was bigger business than in 1954. There were signs of successful competition, though in a small way, on the part of electrical exporters of Continental Europe and of Japan.

Class of Goods	1955 $(000)	Inc. or dec. on 1954 $(000)
Vacuum cleaners	3,244	+ 109
From U.K.	579	− 500
,, Netherlands	73	− 174
,, Sweden	25	+ 1
,, U.S.A.	2,560	+ 780
Washing machines	3,681	+ 656
From U.K.	35	− 42
,, U.S.A.	3,646	+ 699
Batteries, flashlight, and parts	120*	− 9
Batteries, hearing aid, and parts	436*	− 67
Batteries, primary, n.o.p.	365	+ 44
From U.K.	21	+ 3
,, France	12	+ 12
,, U.S.A.	330	+ 29
Batteries, storage, n.o.p., and parts	2,169	+ 333
From U.K.	134	− 112
,, France	10	− 4
,, W. Germany	10	+ 7
,, U.S.A.	2,009	+ 442
Heating apparatus, n.o.p.	1,480	+ 233
From U.K.	32	+ 4
,, W. Germany	17	+ 6
,, U.S.A.	1,426	+ 326
Dynamos, generators and parts, n.o.p.	10,225	+ 874
From U.K.	1,995	+ 1,078
,, W. Germany	33	− 260
,, Sweden	398	+ 284
,, Switzerland	30	− 73
,, U.S.A.	7,743	− 113
Fuses, fuse plugs, cut-outs and parts	1,034	+ 78
From U.K.	89	− 5
,, U.S.A.	944	+ 84
Fluorescent tubes and arc lamps	816*	+ 140
Lamps, m.f.	2,734	+ 956
From U.K.	29	− 24
,, Japan	170	+ 82
,, Netherlands	141	+ 96
,, U.S.A.	2,379	+ 797
Head, side and tail lights and torches	1,545	+ 439
From U.K.	54	+ 18
,, Hongkong	376	+ 186
,, W. Germany	30	− 1
,, Netherlands	8	− 3
,, U.S.A.	1,072	+ 246
Electric light fixtures, n.o.p.	6,096	+ 546
From U.K.	82	+ 15
,, Czechoslovakia	31	+ 13
,, France	22	+ 11
Electric light fixtures, n.o.p. (cont.)		
From W. Germany	90	+ 32
,, Italy	56	+ 6
,, Japan	24	− 30
,, Netherlands	15	+ 9
,, U.S.A.	5,718	+ 498
Lightning arrestors and reactors	385	+ 76
From U.K.	14	− 68
,, Switzerland	45	+ 25
,, U.S.A.	312	+ 138
Meters and parts	2,475	+ 432
From U.K.	281	− 23
,, Japan	20	+ 16
,, Switzerland	45	+ 5
,, U.S.A.	2,117	+ 432
Motors, under $10	341	+ 86
From U.K.	9	− 6
,, Belgium	25	+ 19
,, U.S.A.	299	+ 77
Other electric motors & parts	12,841	+ 871
From U.K.	1,837	− 110
,, Belgium	35	− 34
,, W. Germany	79	− 32
,, Italy	39	+ 38
,, Sweden	147	+ 90
,, Switzerland	49	− 17
,, U.S.A.	10,640	+ 938
Rheostats, controllers and starters	8,559	+ 156
From U.K.	397	− 69
,, W. Germany	11	− 7
,, Switzerland	44	− 23
,, U.S.A.	8,091	+ 250
Irons and parts	720	+ 62
From U.K.	105	+ 50
,, U.S.A.	614	+ 15
Self-contained lighting outfits	66*	+ 13
Sockets, outlets and receptacles	2,641*	+ 833
Switches, switchboards and parts	11,431	+ 664
From U.K.	1,330	+ 175
,, France	37	+ 34
,, Sweden	47	− 47
,, Switzerland	1,027	+ 321
,, U.S.A.	8,951	+ 174
Switchgear for mines	75	− 21
From U.K.	49	—
,, U.S.A.	26	− 21
Telegraph apparatus and parts	2,662	− 608
From U.K.	219	− 462
,, Australia	10	+ 10
,, U.S.A.	2,429	− 156
Telephone apparatus and parts	12,222	+ 1,708
From U.K.	1,889	+ 41
,, W. Germany	27	+ 16
,, Sweden	80	+ 36
,, Switzerland	24	− 38
,, U.S.A.	10,189	+ 1,653
Transformers and parts, n.o.p.	6,595	+ 886
From U.K.	981	− 447
,, Sweden	402	+ 242
,, Switzerland	204	+ 36
,, U.S.A.	4,927	+ 1,003
Radio tubes	12,634	+ 3,831
From U.K.	105	− 101
,, Netherlands	198	+ 78
,, U.S.A.	12,324	+ 3,848
Radio apparatus, n.o.p.	61,002	+ 2,548
From U.K.	4,706	+ 6
,, W. Germany	36	− 20
,, Netherlands	348	− 29
Dry shavers	3,612	+ 416
From U.K.	103	+ 98
,, France	197	†
,, Netherlands	406	+ 40
,, U.S.A.	2,705	− 44
Electric steam generators and parts	4,723	+ 1,710
From U.K.	3,918	+ 2,023
,, Switzerland	505	—
,, U.S.A.	300	− 295
Electrical apparatus, n.o.p.	24,404	+ 1,206
From U.K.	1,209	− 148
,, U.S.A.	22,885	+ 1,529
Electric precision instruments	7,176	+ 1,362
From U.K.	383	+ 59
,, U.S.A.	6,671	+ 1,364
Radio receiving sets	1,306	+ 385
From U.K.	36	− 7
,, W. Germany	59	+ 35
,, U.S.A.	1,185	+ 333
Television receiving sets	513*	− 1,567
Electric refrigerators, n.o.p.	17,847	+ 87
From U.K.	232	+ 86
,, U.S.A.	17,615	+ 3
Porcelain insulators	475	− 32
From U.K.	33	− 77
,, Japan	31	+ 31
,, U.S.A.	390	+ 17
Total	226,700	+ 19,200

* All or mainly from U.S.A.

† Amount negligible in 1954.